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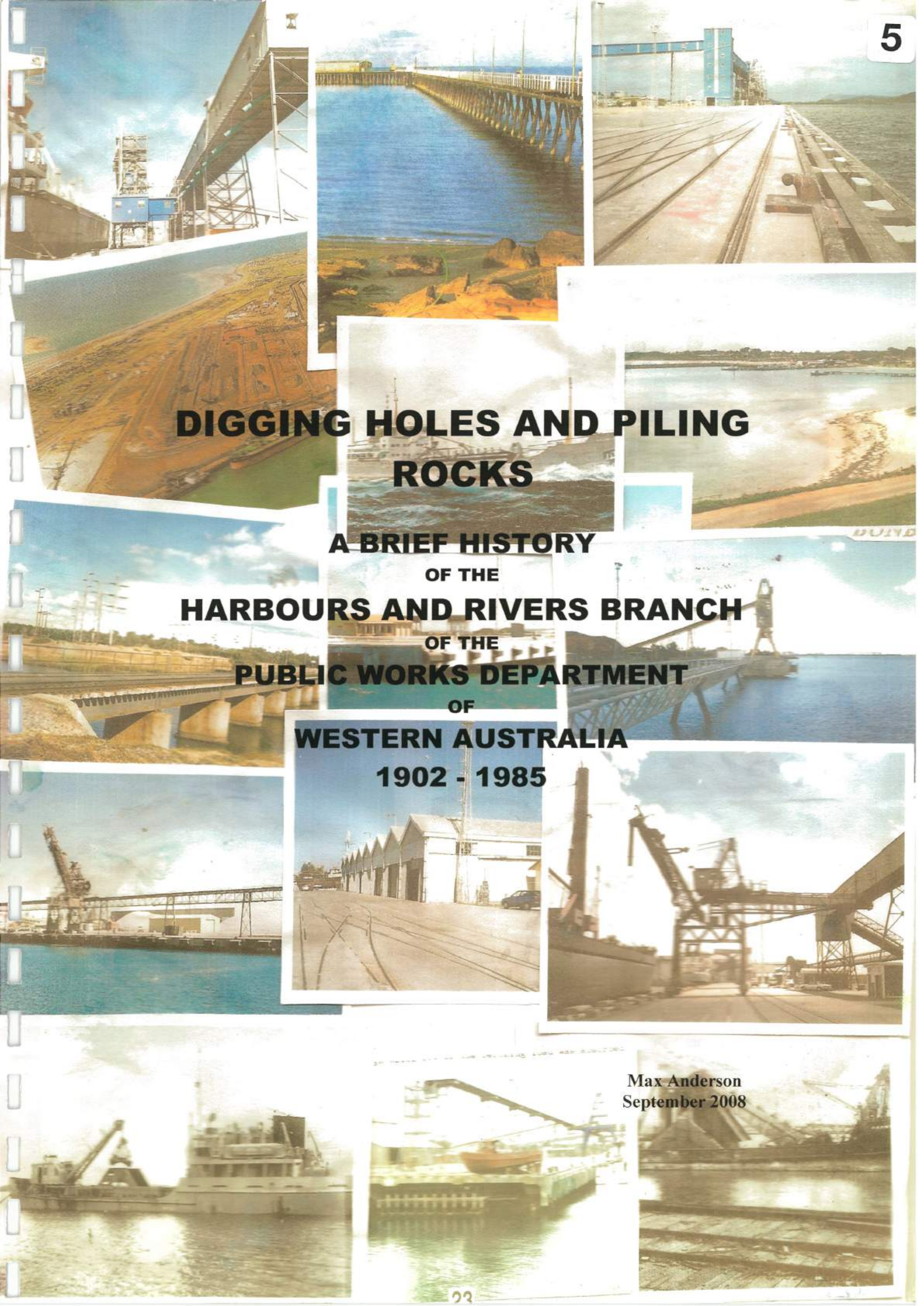

DIGGING HOLES AND PILING ROCKS

A BRIEF HISTORY
OF THE
HARBOURS AND RIVERS BRANCH
OF THE
PUBLIC WORKS DEPARTMENT
OF
WESTERN AUSTRALIA
1902 - 1985

Max Anderson
September 2008

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A Brief History of the Harbours and Rivers Branch of the Public Works Department of Western Australia

Preface

This is but a brief history of one of the branches of the Public Works Department of Western Australia, the Harbours and Rivers Branch, which lost its identity on 1st January 1985.

No better record of the Public Works Department, including the Harbours and Rivers Branch can be found than that written by JSH Le Page on: "Building a State - The story of the Public Works Department of Western Australia 1829 to 1985.

In this submission I have drawn from parts of his book and supplemented it with some additional material covering a brief history of each landing point from Wyndham to Eucla.

I have also included several appendices on aspects of marine works such as dredging, pile driving, railways and breakwater construction.

For the want of a better title I was going to call this book - "Harbours and Rivers Branch History "and then I asked myself – what do port construction engineers actually do?

I then came up with the title – "Digging Holes and Piling Rocks" - that is what it is all about - we find a good protected anchorage and then have to deepen it to take the ships or else we find good deep water close to shore and have to build a breakwater to provide the protection or we have to do both.

And in all its simplicity that is what port engineers in this State have been doing ever since the removal of the rock bar and other material from the mouth of the Swan River and the construction of the north and south moles for the Fremantle Harbour in the late 1890s.

Of course there are other areas where we neither have to dredge nor build breakwaters – just build a jetty or pier out into the water and thank nature for giving us both a relatively protected anchorage and deep water,

But generally the history of the Branch has revolved around one of generally "digging holes and piling rocks" to provide safe efficient facilities for the movement, servicing and loading and unloading of vessels from Wyndham to Eucla.

Max Anderson September 2008

Harbours and Rivers
Public Works Department WA
Marine Works 1950 -1985
Introduction

From the inception of the Swan River Colony in 1829 marine works were first carried out under the supervision of Henry Reveley, the Colony's first Civil Engineer and Superintendent of Public Works.

Public Works covered government buildings, roads and bridges. water supplies, jetties and other marine facilities and later railways.

A separate section was later formed for the development of the port of Fremantle under Fremantle Harbour Works.

It was not until 1896 that the Department was organised into several separate branches, which included Engineer in charge of Roads and Bridges, Harbours and Rivers, Sewerage and Water Supply and a separate branch for Engineer-in-Charge Fremantle Harbour Works.

In 1902 C.S.R. Palmer was appointed as Engineer in Chief to succeed CY O'Connor and with the completion of the major works at Fremantle the separate branch of Fremantle Harbour Works was absorbed into the Harbours and Rivers Branch, with A.W. Dillon Bell being appointed as Engineer in Charge, Harbours and Rivers with William Leslie, who had been the Resident Engineer at Mundaring Weir being his deputy.

Following the ultimate reorganisation of the Public Works Department in 1985 the Harbours and Rivers branch was dissolved and lost its identity after nearly 90 years, with MG Anderson being the last Engineer in Charge, (retitled Chief Engineer). Harbours and Rivers,
The previous occupants of this position were

AW Dillon Bell	1902 - ....)	
EH Carlin	- 1925)	23 years
J Stevenson Young	1925 – 1948	23 years
F Tydeman	1948 - 1952	04 years
NJ Henry	1952 - 1965	13 years
JD Gillespie	1965 - 1972	07 years
MG Anderson	1972 - 1985	13 years

The following is a brief précis of works carried our by the Harbours and Rivers Branch of the Public Works Department of Western Australia mainly between 1950 and 1985 with some reference to earlier marine works carried out within the State.

As an introduction to each project a recent aerial of the site has been included to show the development which has taken place since 1985

Attention is also drawn to the length of time taken to complete some of the projects shown in the following pages, It must be appreciated that in most cases funds for carrying out the work were limited, necessitating some works to be staged and for others to be deferred from year to year depending on the priority of development of all port and marine works in the State

Max Anderson
September 2008

Harbours and Rivers Branch
Public Works Department WA
Marine Works 1950 -1985

Contents

A Brief History of Port Development in Western Australia

Possibly the most active period in the provision of marine facilities in the history of Western Australia took place between 1880 and 1910. During this period new jetties or landings were constructed or existing facilities were extended at Albany, Balla Balla, Broome, Bunbury, Busselton, Carnarvon, Derby Cossack, Dongara, Esperance, Eucla, Flinders Bay, Fremantle, Geraldton, Onslow, Hamelin Bay, Hopetoun, Israelite Bay, Mandurah, Maud's Landing, Point Samson Hedland, Quindalup, Rockingham, Wonnerup and Wyndham.

All of these structures were of a basic design, generally using Western Australian hardwoods for all the components of the Jetty. The basic Jetty was a timber piled structure with two adzed or sawn timber half caps at each pier, with the pier centres being in the order of 12 feet. The Jetty super structure comprised transverse 9 inch by 4 inch decking, spiked to longitudinal 12 inch by 6 inch beams, generally staggered over the piers so that each beam was supported on three sets of half caps. In some cases short lengths of timbers, known as corbels supported the beams over the half caps to reduce the free span of the beams and so improve the loading capacity of the deck.

The lower part of the structure was braced with horizontal waling pieces bolted to the piles near low water mark and cross bracing timbers bolted to the piles just above the walings and just below the halfcaps. Most jetties carried a light railway for transporting goods between the shore and the berthing head of the Jetty. Unloading and loading of goods on shore was normally carried out manually, although light fixed one ton capacity hand cranes were sometimes used in the goods yards on shore. The loading or unloading of cargo at the berthing head was generally carried out using ship's gear.

Jetties were designed mainly for the vertical loads imposed on them by cargo loading and deck traffic with some allowance for transverse loads caused by weather and shipping. In order to reduce berthing loads, a separate fender system was sometimes used which was supported by piles and timbers independent of the jetty structure Although this reduced the transverse loading from shipping it had the opposite effect on the Jetty when it came to adverse sea conditions. Many a fender system under severe storm conditions became a gigantic battering ram to the Jetty itself, resulting in the loss of all or part of the Jetty.

The height of the Jetty deck above high water also created a problem. If the deck was too high it was some times too difficult to work a vessel at other than high tides If the deck was too low it was prone to uplift during storms. This was particularly a problem in the northwest ports of the State where a high tidal range dictated a lower deck level, making the

structure more vulnerable to storm or- cyclone damage, particularly if the storm or cyclone hit at high tide.

Jetties or landings were located primarily from a land use aspect, which meant that many structures were not necessarily built in the best location with respect to shelter and depth of water.

Up to 1897 cargo in the State was handled over timber Jetties similar to the type described above. These structures were continually being extended and strengthened to meet shipping requirements both in draft and size. In 1897 the first facility of this type was replaced with land backed wharves, in the development of the inner harbor at Fremantle. However apart from Fremantle all other ports in the State continued to use jetties for loading and unloading cargo. The first regional port to replace its Jetty with a land backed berth was Geraldton when the first of three land backed wharves was commissioned in 1930. This was followed by Albany, with the first land backed berth being constructed in 1954.

These early structures played a very important part in the opening up of the State. They preceded road and rail and provided the only means of transport from Eucla to Wyndham. - At the turn of the previous Century, rail was replacing intra state sea transport in the south. With the relatively recent advent of all weather roads in the north of the State, road has now replaced the majority of intra state sea transport since the 1970s.

It was not until the 1960s that the next expansion of ports took place, as a result of the increase in the mining, pastoral & agricultural industries. At the same time there was also an up turn in the fisheries which resulted in new and upgraded facilities for the fishing industry being provided at Esperance, Hopetoun, Albany Augusta, Bunbury, Mandurah, Fremantle, Lancelin, Cervantes, Jurien Bay, Leeman, Port Denison, Geraldton, Port Gregory, Denham (Shark Bay), Carnarvon , Point Samson and Onslow.

As always, the design of all the structures was dictated by the type of vessel which would be using the facility with respect to draft, loaded displacement, shape, length and beam, the type of cargo being carried by the ship, the handling facility on the ship and that required on the structure.

This covered conventional merchant ships, bulk carriers, container ships, specialized ships used for the carrying of livestock and car "ferries". With the introduction of large bulk carriers requiring heavy loading or unloading installations at the berth and with specialized container ships with stern or quarter- ramps. requiring heavy strength deck sections, the type of structure, which had almost been standard for the last eighty years, underwent a great change. Timber piles were replaced with tubular steel piles and the whole timber super structure was replaced with reinforced concrete.

Between 1960 and 1970 all of the existing timber jetties still being used at that time for port activities were replaced, supplemented or modified.

The three jetties at the Kimberley Ports of Wyndham, Derby & Broome were replaced with steel and concrete

The jetties at Wyndham and Derby were built on the same site whilst the one at Broome was relocated at Entrance Point, five kilometres from the site of the timber jetty.

Due to the large tidal range at the Kimberley ports economics ruled out the replacement of these jetties with the more versatile land backed wharf, However provision was made on all three jetties for through or turnabout road traffic between the shore and the berthing head. In the case of Wyndham and Derby, provision for rail traffic was originally retained on the new structures. During the same period extensive works were also carried out at the regional ports of Albany, Bunbury, Esperance, Geraldton and Port Hedland. It was also in this period that Company iron ore export ports were established at Finucane Island, Port Hedland for Goldsworthy Mining Pty Ltd; Port Hedland for Mount Newman Mining Pty Ltd; Cape Lambert near Point Samson for Robe River Mining Pty Ltd and Dampier for Hamersley Iron Pty Ltd. Salt export facilities were also established at Port Hedland; Dampier; Useless Loop at Shark Bay, Cape Cuvier about 100 kms north of Carnarvon and Esperance. A wood chip export facility was established at Bunbury together with a loading berth for the export of alumina.

Imperial to Metric Conversion

All units have been expressed generally as those applying at the time and no attempt has been made to convert them from imperial to metric.

Currency

One pound = 20 shillings = 240 pence = $ 2

Weights and Measures

Length	One inch =	2.54centimetres
	One foot =	30.84centimetres
	One yard =	3 feet= 0.914 metres
	One chain =	66 feet 20.12 metres
	One mile =	80 chains = 5289 feet = 1609 metres
Area	One acre =	43,560 sq feet = 0.4047 hectares
Volume	One cubic foot =	0.0283 cubic. metres
	One cubic yard = 0.7646 cubic metres.	
	One acre foot = 271,300 gallons - 1233 cubic metres	
	One million imperial gallons= 4546 cubic m.	
	One gallon =	4.546 litres
Weight	One ton	=1.016 tonnes
Pressure	One pound per square inch	= 6.895 kilopascals

Temperature

32 degrees Fahrenheit 0	degrees Centigrade
212 degrees Fahrenheit	100 degrees Centigrade
100 degrees Fahrenheit	38 degrees Centigrade

Precipitation

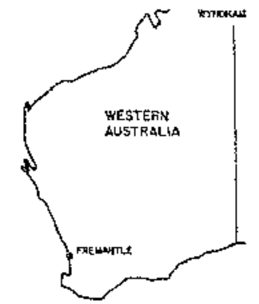
One Inch = 100 points= approximately 25 millimetres

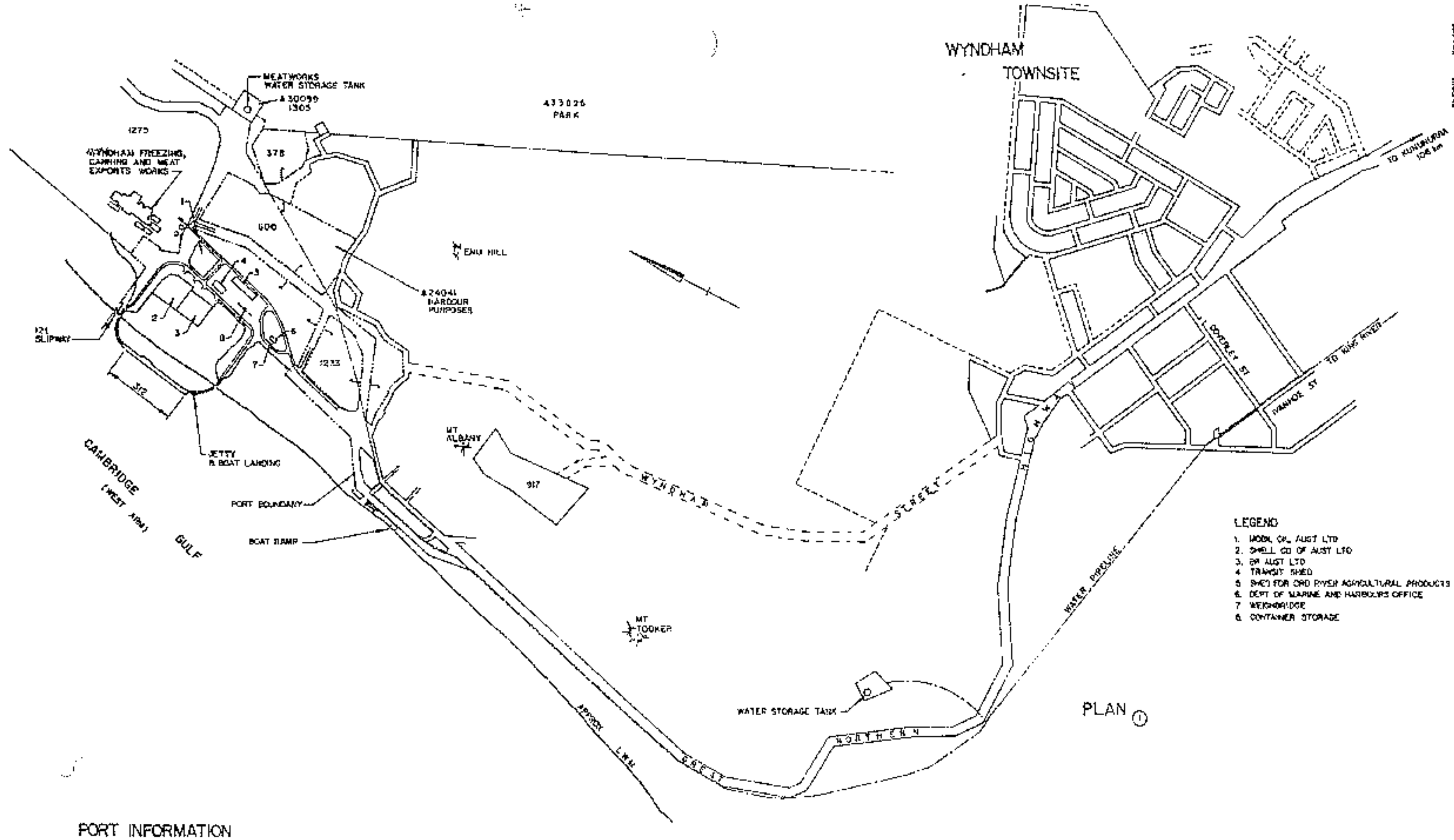
Kimberley

The Port of Wyndham, Cambridge Gulf 2007

google earth

PORT OF WYNDHAM LOCALITY PLAN





PLAN 1

PORT INFORMATION

POSITION
LAT 15° 27'S, LONG 128° 06'E

DATUM
INDIAN SPRING LOW WATER (CHART DATUM) WHICH IS ZERO ON THE TIDE GAUGE AND 4.104m BELOW AHD.

ACCOMMODATION
GOOD ANCHORAGE IN CAMBRIDGE GULF IN 9.1m OVER MUD, SAFE IN ALL WEATHER CONDITIONS, BUT BERTHING APPROACH MUST BE MADE WITH CAUTION DUE TO SHOALS AND THE WRECK 'KOOLAMA'. STEEL JETTY (CONCRETE DECKED) HAS 312m BERTHING HEAD ON WESTERN SIDE. DEPTH ALONGSIDE IS 9.1m ISLW WITH A TIDE RISE OF 7.8m. GOODS SHED AND BONDED STORE IN GOODS YARD. CONTAINER YARD FOR STORAGE OF REEFER CONTAINERS AND DRY CONTAINERS IS ALSO AVAILABLE.

IMPORTS
GENERAL CARGO.

EXPORTS
MEAT AND MEAT PRODUCTS, AGRICULTURAL PRODUCTS FROM THE ORD RIVER AGRICULTURAL AREAS.

CARGO HANDLING
BY SHIP'S GEAR ON AND OFF ROAD TRANSPORT, ONE SHIPLOADER, ONE 12 TONNE COLES MOBILE CRANE AND FIVE FORK LIFTS. BELT CONVEYORS ARE ALSO AVAILABLE.

FRESH WATER
AVAILABLE FROM THE BERTH.

OIL SERVICE POINTS
PROVIDED AT BERTH FOR THE DISCHARGE OF REFINED PETROLEUM PRODUCTS

ELECTRICAL SERVICES
POWER AND LIGHTING SUPPLY AT 440/250V 50Hz. FLOODLIGHTING IS PROVIDED FOR NIGHT WORKING. 30A 3PHASE 440V 50Hz POWER OUTLET SOCKETS ARE INSTALLED ALONG BERTH FACE FOR SUPPLY TO HOLD FANS AND SIMILAR APPARATUS. DISCHARGE OF FLAMMABLE CARGO AT NIGHT IS POSSIBLE BY SPECIAL ARRANGEMENT WITH THE HARBOUR MASTER.

ROAD SERVICES
CONNECT THE JETTY WITH THE HINTERLAND OF THE NORTH KIMBERLEY AND THE ORD RIVER AGRICULTURAL AREA.

PORT OPERATING AUTHORITY
DEPARTMENT OF MARINE AND HARBOURS, FREMANTLE.

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED AND PREDICTIONS ARE AVAILABLE.

PILOTAGE
PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER.

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATIONS

REFERENCE PLANS

REFERENCE PLANS	PWD., WA
JETTY	39504, 47372
FENDERING	46309, 49662
EXTENSION - 22m (PIERS 03 - 08A)	46309
- 30m (PIERS 08A - 10A)	46309
CONTAINER STORAGE & HANDLING FACILITIES	51046
SOUNDINGS OVER BERTH (1962 ONWARDS)	39470 BK 1, 2, 3 & 4
CAMBRIDGE GULF SOUNDINGS (1973 ONWARDS)	46235
HYDROGRAPHIC SURVEY (1968)	45027
NAVIGATION AIDS	55059
PORT BOUNDARY	39065
SLIPWAY (121)	43017
ADMIRALTY CHARTS	AUS 32, BA 1047

00 50 0 100 200 300 400 500 600 700
SCALE OF METRES 1
(1:20000)

ZONE	DATE	REVISION	DR'N	APP'D

SURVEY BOOKS			FILE No
			PW 240/45

GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES
1. SEE DRG 53923-2-2 FOR CROSS SECTIONS AND DESIGN LOADINGS.

REVISED TO DEC 31, 1983

SCALES AS SHOWN
MICROFILMED
DATUM
AS SHOWN

DESIGN CALC — BOOK
CHECKED — BOOK
DRAWN CS/PJS — CHECKED CS/45
TRACED — CHECKED
SUPERVISING DESIGN ENGINEER, N & R
SUBMITTED — DATE 29 12 83
CHIEF DESIGN ENGINEER
APPROVED — DATE 29.12.83
CHIEF ENGINEER, HARBOURS & RIVERS

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF WYNDHAM
LOCALITY PLAN AND SERVICES DATA

P.W.D., W.A. 53923-2-1

REV'N

01 Wyndham

Early History

In 1881 Wyndham became a recognised landing place for the east Kimberley and the town of Wyndham was proclaimed in 1886 with the first jetty being constructed at Anthon landing in 1887.

Between 1916 and 1918 a timber jetty with a 918 feet long neck and a 300 feet long head was built at Stony Point to service the Wyndham Meat works.

In 1942 the MV Koolama which was attacked at Cape Londonerry by our Japanese aggressors during WW 11 "limped" into the Wyndham Jetty and rolled over and sunk at the berth... In the late 1940s it was raised by compressed air, moved to deeper water off from the jetty and sunk where the hulk still lies today as a memorial.

Harbour Development 1950s

The 1918 timber Jetty at Stony Point, known as the Meat works Jetty, was replaced with a steel tubular piled Jetty with longitudinal steel beams, transverse timber beams and longitudinal decking at a total cost of 880,000 pounds, between 1959 and 1961, with the first pile being driven on 31st May 1959. The Resident Engineer for the project was Jim Butcher who was assisted for part of the time by assistant engineers Bill Andrew and Glen Ketteridge. The Engineer for Harbours and Rivers was then NJ Henry

In 1970/71 dredging continued at the berths, removing silt, using the grab dredge "Fremantle". Three extra beacons were placed at Hare Channel in Cambridge Gulf and work commenced on a shore based container freezer installation. Plans also were prepared for a southern extension of the Jetty to accommodate longer length vessels.

Investigations also proceeded for a possible new port site at Cape Domett, some 70 miles from Kununurra at the northern end of Cambridge Gulf.

In 1971 72 the replacement of the badly deteriorated timber beams and timber decking on the remainder of the old Wyndham Jetty with steel beams and a reinforced concrete deck was commenced as a part of a major deck reconstruction programme. Existing Jetty sheds were cantilevered clear of the main deck to provide more deck space for rail sidings. The Dredge Fremantle carried out investigation work at Cape Domett.

In 1972 73 Replacement of the timber deck with reinforced concrete continued. Tenders were accepted for the installation of two shore based freezer units.

In 1973 74 Replacement of the timber, deck of the Jetty with reinforced concrete in the south berth was completed. An extension of the south berth by 72 feet to take a travelling ship loader for the bulk loading of grains from Kununurra was commenced

Between 1975 and 1977 a travelling shiploader was installed on the Jetty.

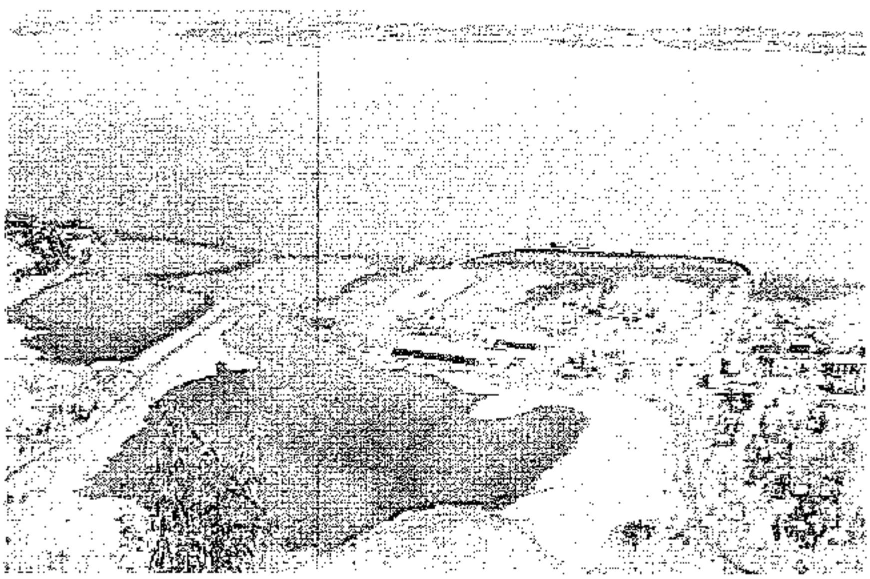
The resident engineer for Wyndham Harbour Works in the 1970s was Darryl Rapley and the Engineer, Harbours and Rivers was MG Anderson..

In 1978 79 and 1979 80 the upgrading of the fender system on the Jetty, a short extension of the Jetty southwards to take the shiploader and the replacement the timber decks in both the approach necks with concrete were completed.

A bituminised container park was provided in the Wyndham Goods Yard and five new navigational markers were positioned in the outer channel.

In 1980 81 and 1981 82 a concrete pad was provided in the container yard for washing down containers and a 20 metre extension to the park was sealed. The Jetty fender system was extended a further 5 m southwards.

1982 83 – 1984 85 grab dredging was carried out at Wyndham at the berth face. A new work shop to service container handling plant was constructed and an internal road system within the goodsyard was revamped and existing rail sidings were removed.



The port of Wyndham on Cambridge Gulf taken from the Five Rivers Lookout on the Bastian range with the northern end of the town of Wyndham on the left and the site of the old meatworks on the right. The original jetty at Anthon landing was on the extreme left.
Wyndham Jetty Construction 1960

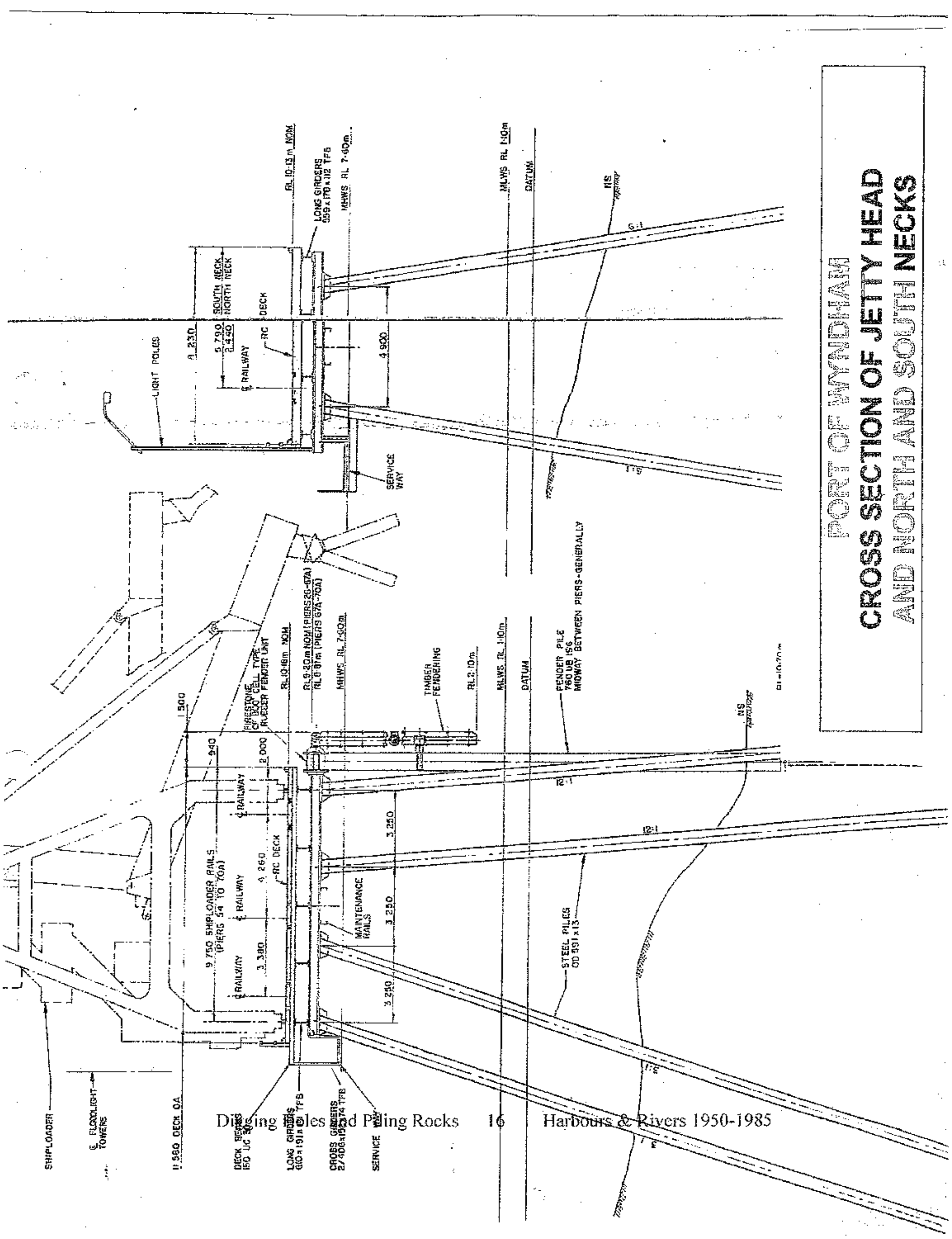
Wyndham Jetty Construction 1960
Jim's Story

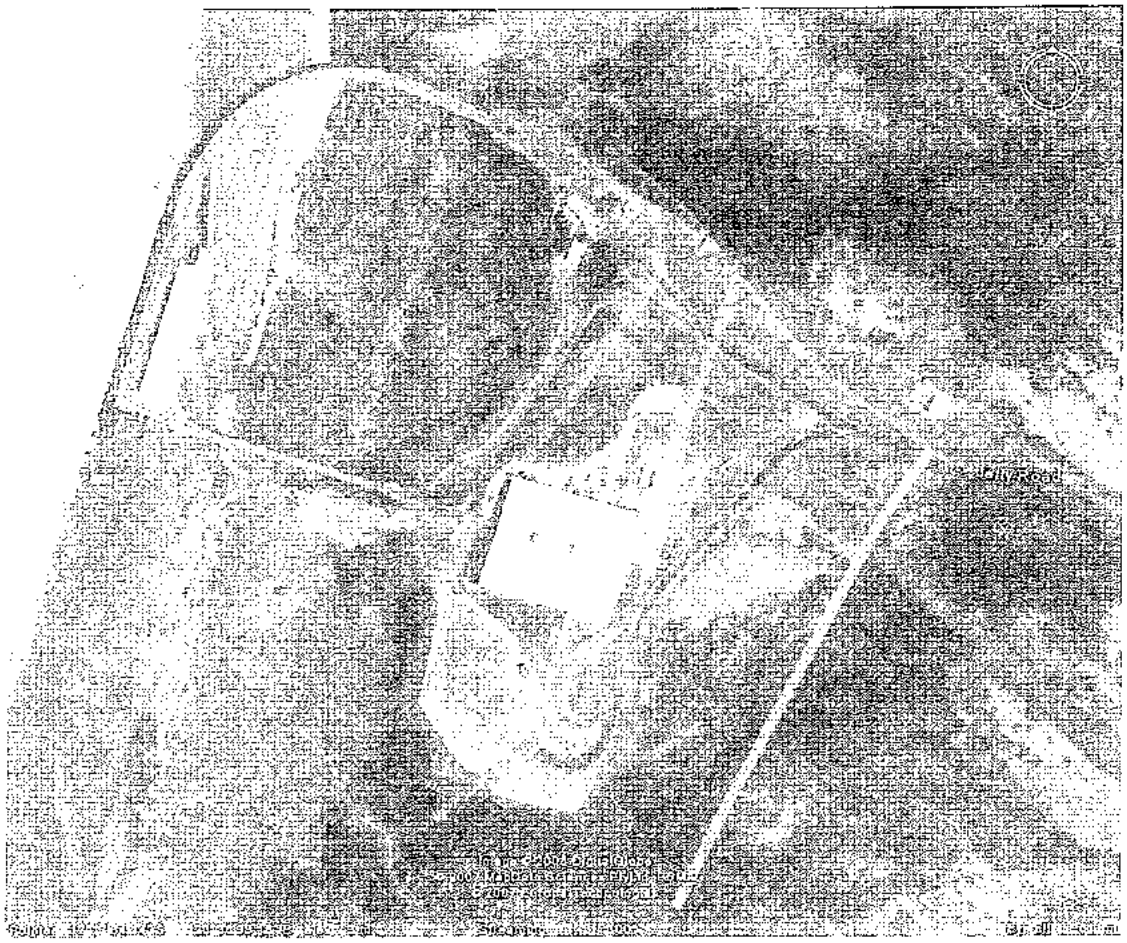
The driving of the steel tubular piles on the Wyndham Jetty was carried out using a 65 feet high steel pile frame, mounted an a barge. All other equipment as the boiler, piling and mooring winches was also located on the deck of the barge. The barge used at Wyndham consisted of a number of 13'6" x 5'6" x 5'6" Braithewaite boxes bolted together to form one large pontoon.

There were also a couple of sheds set up on the barge together with wire slings, mooring wires and other equipment associated with the driving of the steel piles. The deck of the barge was therefore pretty well cluttered, apart from one area on which a large red and white bull's-eye was painted. This was the "no go" area, where things like wire slings, shackles, twitches etc were dropped from the landings on the pile frame to the deck below. Jim who had a very dry sense of humour recounted to me how one morning, quite early, he had been called down to the Jetty to view, the pile driving barge which had somehow or other, overnight lost all its equipment off the deck.

The barge had been moored just off the jetty. Jim said that all that was left was a clear steel deck, even the painted bull's eye had been removed. Then he said that it suddenly dawned on him that, the equipment had not been stolen. It was still on the barge. It was just that the barge had flipped over 180 degrees and all the equipment and the pile frame were dangling down into the brown murky depths of Cambridge Gulf. What he was now looking at was the clean uncluttered surface of the underside of the pontoon.

This was a major catastrophe in the building of the Jetty. Apparently water had entered several of the boxes on the port side of the pontoon causing it to list to such an extent that the metacentre took over from the centre of gravity and flipped the barge over on its back. The up righting of the barge involved some very hazardous diving work in the reballasting of some of the boxes and the recovering of equipment hanging from the upturned barge.


PORT OF WYNDHAM
CROSS SECTION OF JETTY HEAD
AND NORTH AND SOUTH NECKS
SHIPLOADER
℄ FLOODLIGHT TOWERS
11 580 DECK OA
DECK BEAMS 150 UC 30
LONG GIRDERS 610×191×101 TFB
CROSS GIRDERS 2/406×152×74 TFB
SERVICE WAY
9 750 SHIPLOADER RAILS (PIERS 54 TO 70A)
℄ RAILWAY
RC DECK
MAINTENANCE RAILS
STEEL PILES OD 591×13
FENDER PILE 760 UB 156 MIDWAY BETWEEN PIERS-GENERALLY
FIRESTONE CF 1600 CELL TYPE RUBBER FENDER UNIT
TIMBER FENDERING
RL 10·16m NOM
MHWS RL 7·60m
MLWS RL 1·10m
DATUM
NS
12:1
6:1
LIGHT POLES
SOUTH NECK
NORTH NECK
DECK
LONG GIRDERS 559×170×112 TFB
RL 10·13 m NOM



The Port of Derby, King Sound 2007 google earth

02 Derby

Early History

The sea approaches to Derby were first surveyed in 1882 with the town of Derby being proclaimed in 1883. The first jetty was built in 1886 which was accessible to the land by a mile long causeway over the tidal flats, which carried a cattle race and a 3'6" gauge horse drawn tramway. Both Derby and Wyndham competed as the entry point for traffic entering the Kimberley Goldfield centred around Halls Creek after its proclamation in 1885

Apart from the ongoing maintenance of the 1886 timber Jetty and its associated ancillaries no major port works took place until 1964 when the old timber Jetty was replaced with a steel tubular pile, steel and concrete decked structure located adjacent to the existing Jetty.

Harbour Development 1960s

Under a multi million pound Commonwealth assisted port development programme, new jetties and port facilities were provided at Wyndham, Derby and Broome, the three ports of the Kimberley region. The new Derby jetty was built on the southern side of the existing timber jetty. The new jetty comprised a 758 feet long curved approach, 26 feet wide, leading to a 516 feet long berth, located in approximately the same depth of water as that at the old Jetty. At the southern end of the berth an 18 feet wide structure led back to the shore. This structure carried a roadway for the in and out movements of Jetty traffic and a cattle race to a loading ramp on the jetty. Along the same alignment of the berth and to the south, there were two dolphins, which allowed two coastal ships of up to 300 feet in length to be berthed at the same time.

Apart from the abutment piles all the tubular steel piles in the structure were pitched and driven using floating plant, the steel super structure was placed using jib cranes working from the partly completed jetty deck. Due to the tidal variations at the jetty, it was only possible to maneuver the pile-driving barge and drive piles whilst there was still flotation. The whole area over which the piles were to be driven dried out completely at low tide and all floating plant sat on the dry seabed until the next tide. There were two tides a day, which ranged from a top of 36 feet down to zero feet during Spring tides and from about 25 feet down to 10 feet or slightly less in neap tides. Construction of the new jetty commenced in early 1963 and was operational by November 1964. The jetty was opened by the Minister for Works and Water Supplies on 14th October 1865. The old timber Jetty was demolished early in 1965.

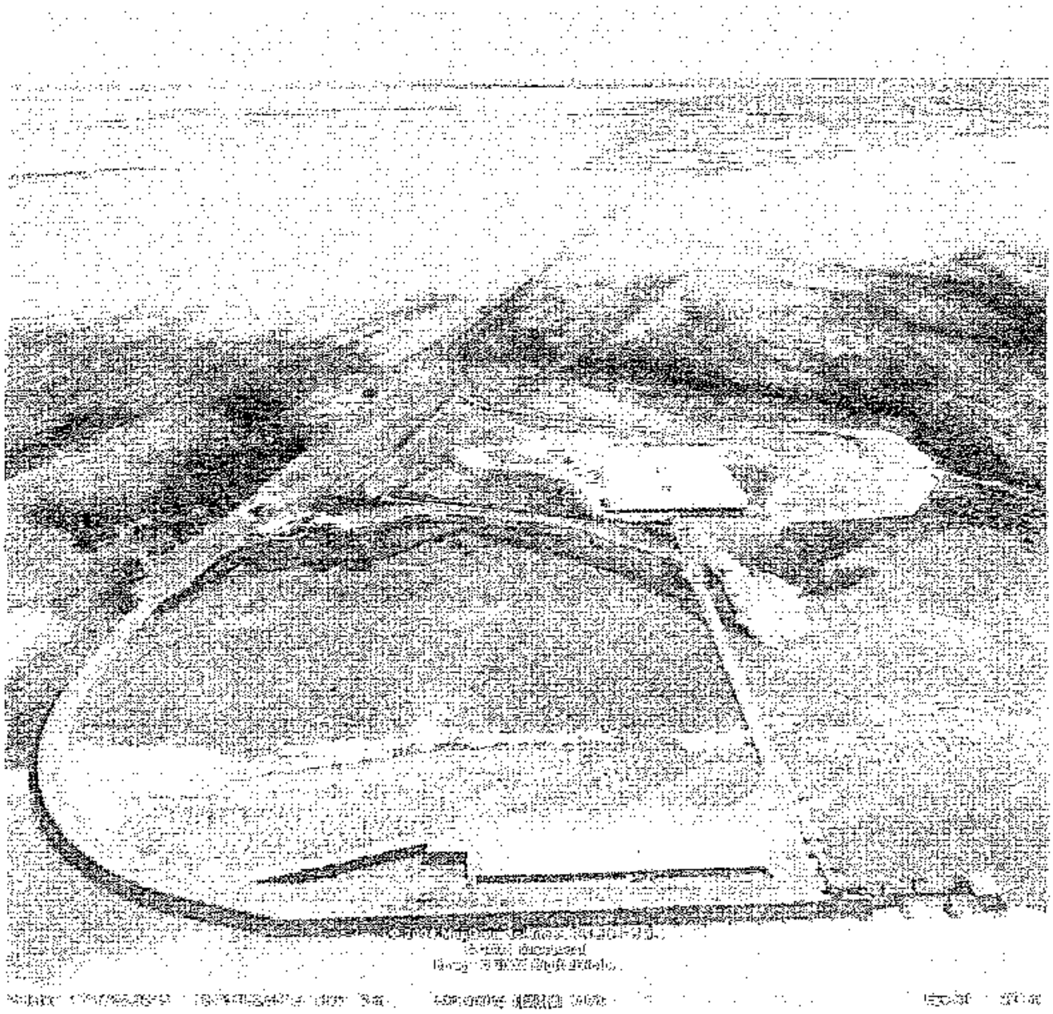
The Resident Engineer for the project was Max Anderson assisted by assistant engineer Bill Andrew and the Engineer for Harbours and Rivers was NJ Henry.

In 1972 73 further work was carried out in levelling of the sea bed to accommodate the Blue Funnel Line vessel Centaur and the new State Shipping Service vessels, when sitting on the bottom.

Between 1972 and 1975 7 a chiller and freezer unit was installed in the jetty transit shed for handling perishable cargo.

In the early 1980s the seaward approaches to the jetty were resurveyed and investigations carried out as to the feasibility of deepening the port. Due to navigational problems in the approach to the Jetty, the port was eventually closed in 1983

It was reopened in 1997 as an export facility for lead and zinc ore,



The 1965 Steel jetty at Derby showing the road causeway (left) and the cattle lead (right) leading back to the town of Derby, The site of the 1886 jetty was to the far left adjacent to the north neck, The cattle race on the south neck has now been replaced with a ore conveyor leading from lead ore storage sheds on reclaimed land near the south neck abutment to a fixed ore loader at the jetty face,

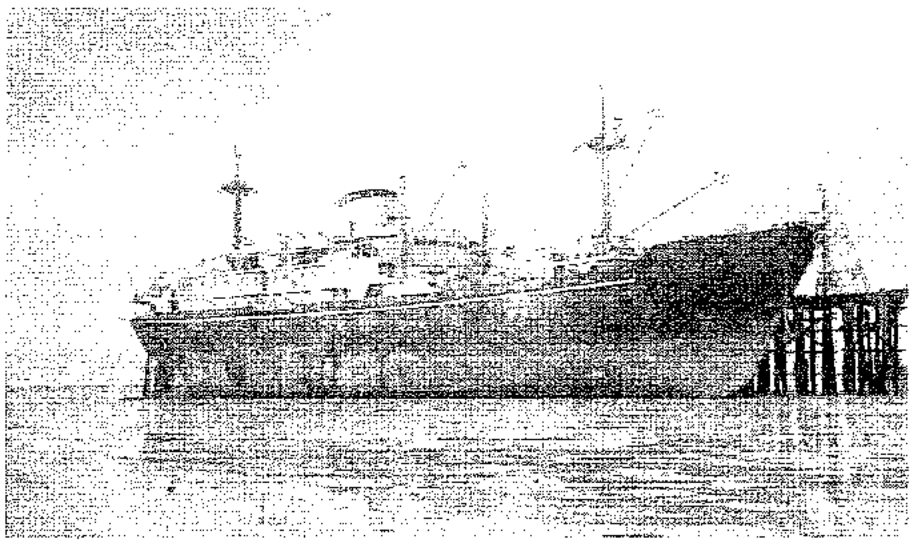
Derby Jetty Construction
Max's Story

Two of the main exports over the Derby jetty were empty containers and cattle. The empty containers as listed in the ships manifest were empty beer kegs. Live cattle were driven overland along the West Kimberley stock routes or else brought by road train to Mayalls bore and cattle yards, a few miles out of Derby and then driven around the tidal flats to the mile long cattle race leading to the Jetty.

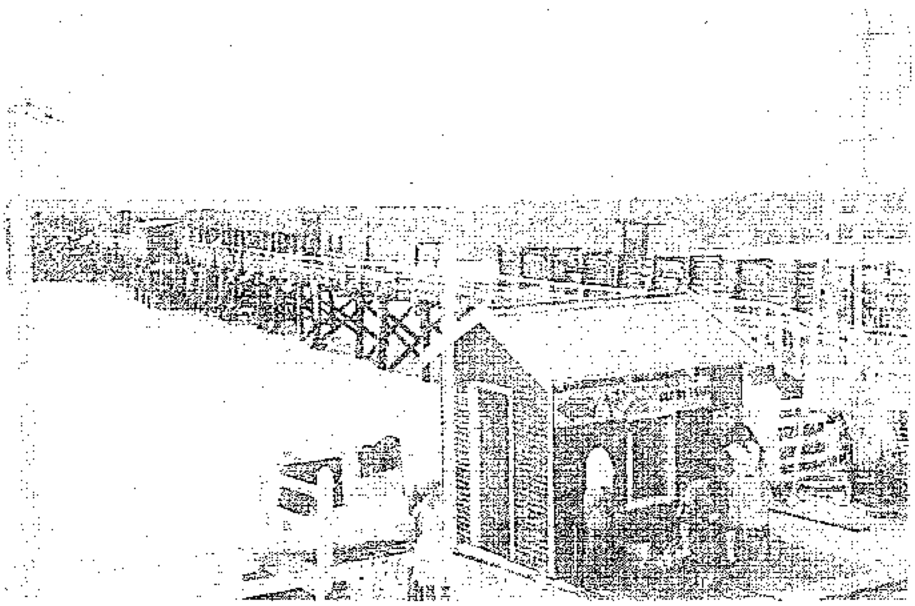
At the jetty the cattle were held in stockyards and then driven down a single beast race along the neck of the jetty via a hinged walkway onto the ship. The walkway, which was hinged at the jetty end, rested on the deck of the ship and went up and down with the tide.

During the building of the new jetty at Derby, which was located adjacent to the old one, the port operation had to continue in the middle of a construction area. This required close liaison between the port operator and the Jetty builder. One of the problems was the handling of cattle in temporary races through construction the areas. At the jetty end of the race was a large silver painted fuel tank, at which the cattle, on their way down south to market would tend to balk.

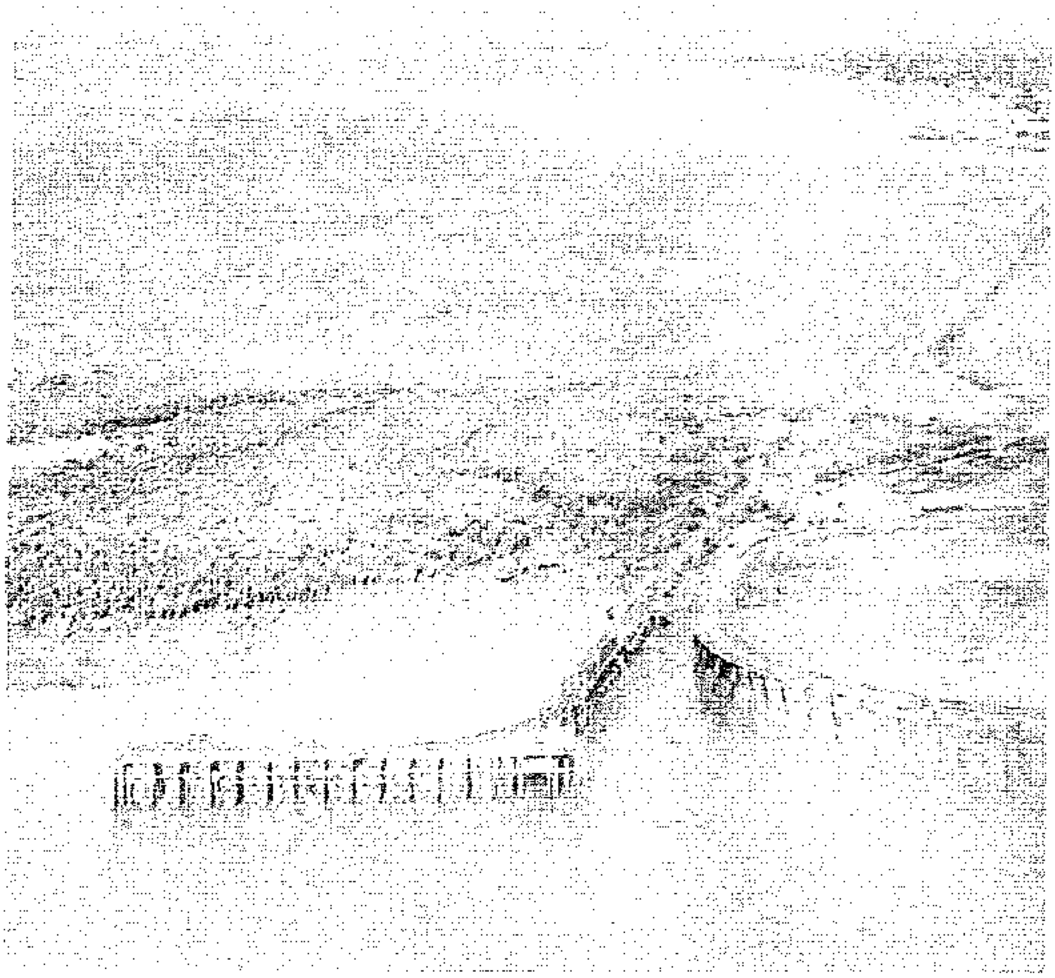
There was a suggestion that perhaps it should be painted a softer colour, so the cattle would not be startled by it. However, one of the local businessmen, possibly of Irish descent, considered that there would be no need to paint the tank, because he said that, he was sure that in no time the cattle would get used to it.



State Ship MV Koolama sitting on sea bed at Derby Jetty

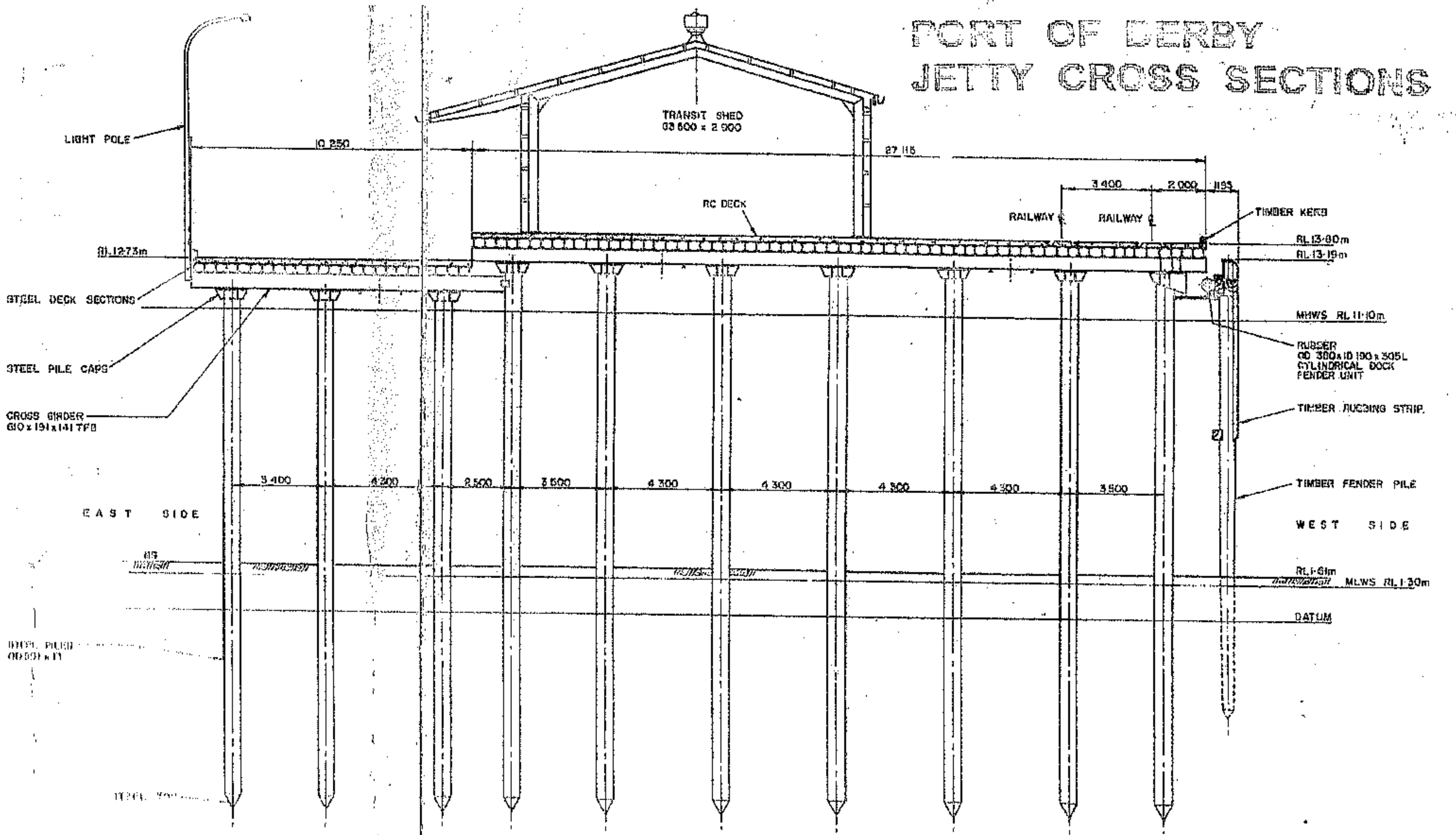


Derby Jetty old timber jetty, early 1960s taken from the upper deck of a State Shipping vessel – the building in the foreground was the wharfinger's office, "bond store" and "passenger terminal". The two ladies in white are no doubt there to welcome friends or family returning from Perth.



Aerial view of the old timber jetty at Derby on the left and the north neck of the "new" steel and concrete jetty under construction on the right. Part of the town of Derby can be seen at the top right hand side of the photograph.

PORT OF DERBY
JETTY CROSS SECTIONS



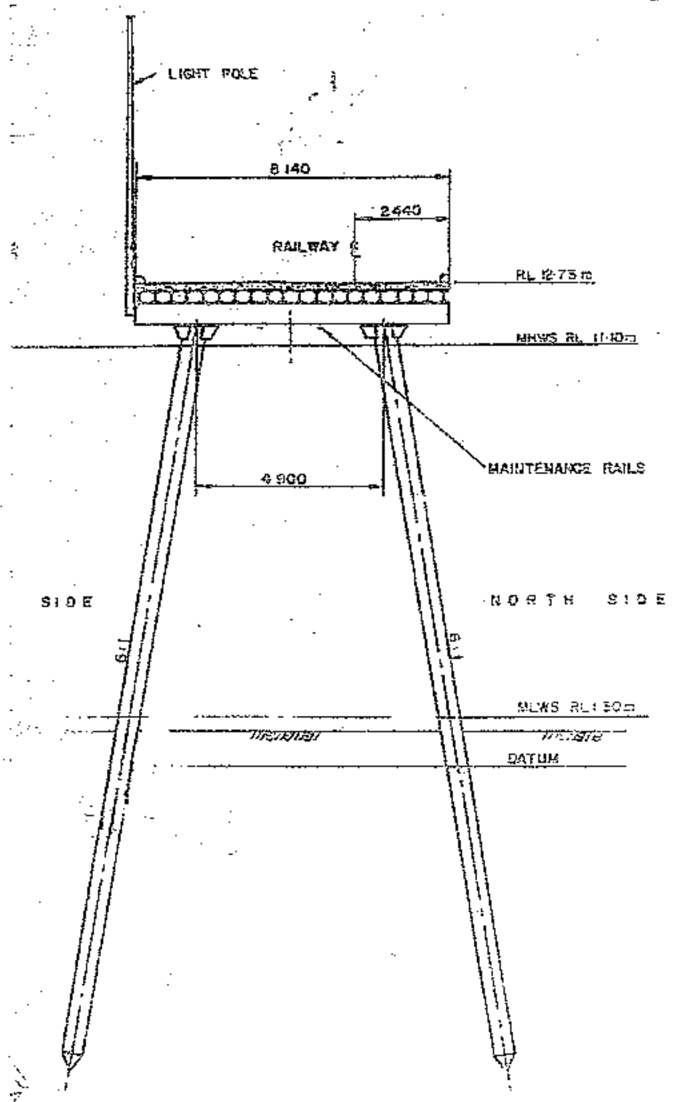
CROSS SECTION THROUGH HEAD ①

DESIGN LOADINGS ON HEAD

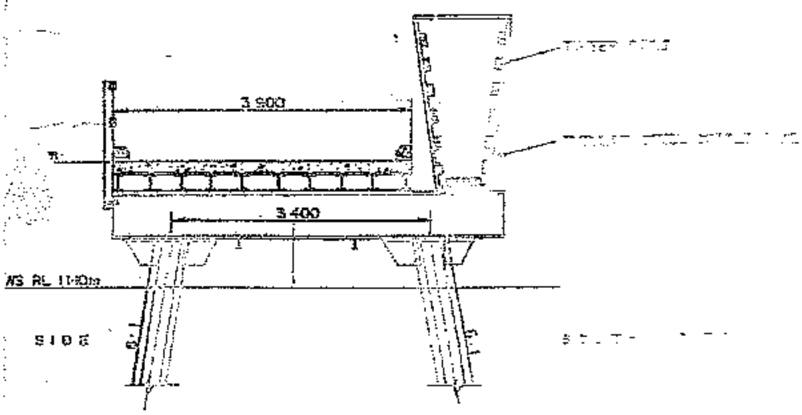
Ⓐ STACKED LOAD
3400 kg/m²

Ⓑ RAILWAY LOAD

PORT OF DERBY
CROSS SECTION OF JETTY HEAD



PORT OF DERBY
CROSS SECTIONS OF
NORTH AND SOUTH NECKS

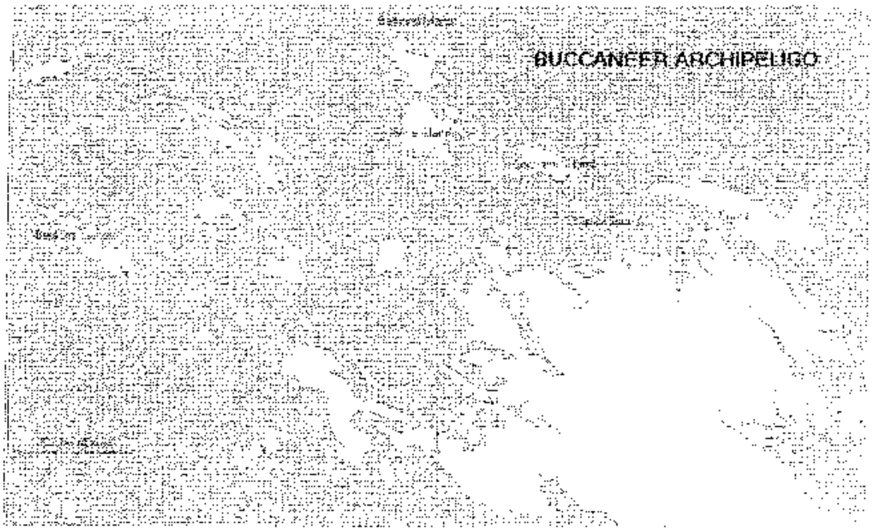


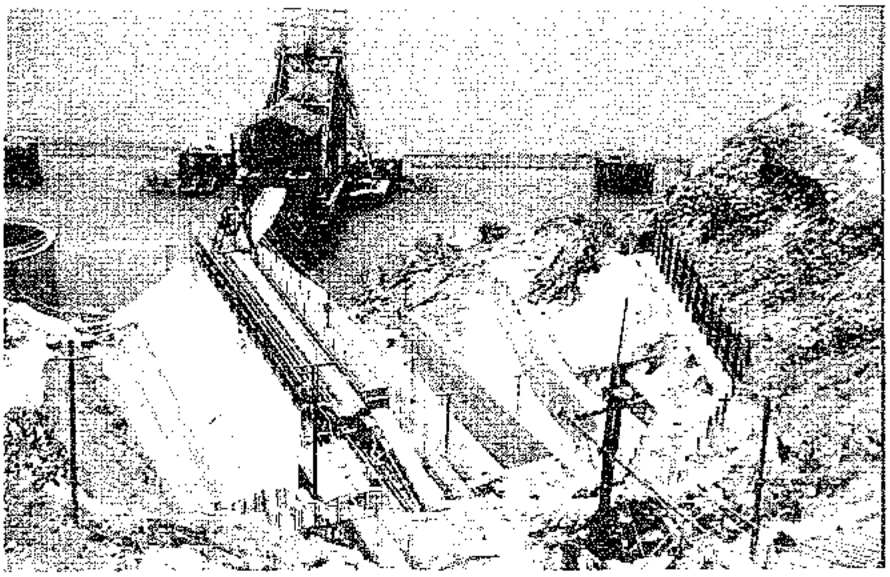
CROSS SECTION THROUGH SOUTHERN NECK
(PIERS AT 9 145 CENTRES NOM)

03Yampi Sound

Between 1951 and the early 1980s iron ore was mined and exported over BHP owned and operated ship loading facilities at Cockatoo and Kooolan Island in Yampi Sound to the north of the entrance to King Sound.

The Company maintained a regular sea and air service between Derby and Yampi



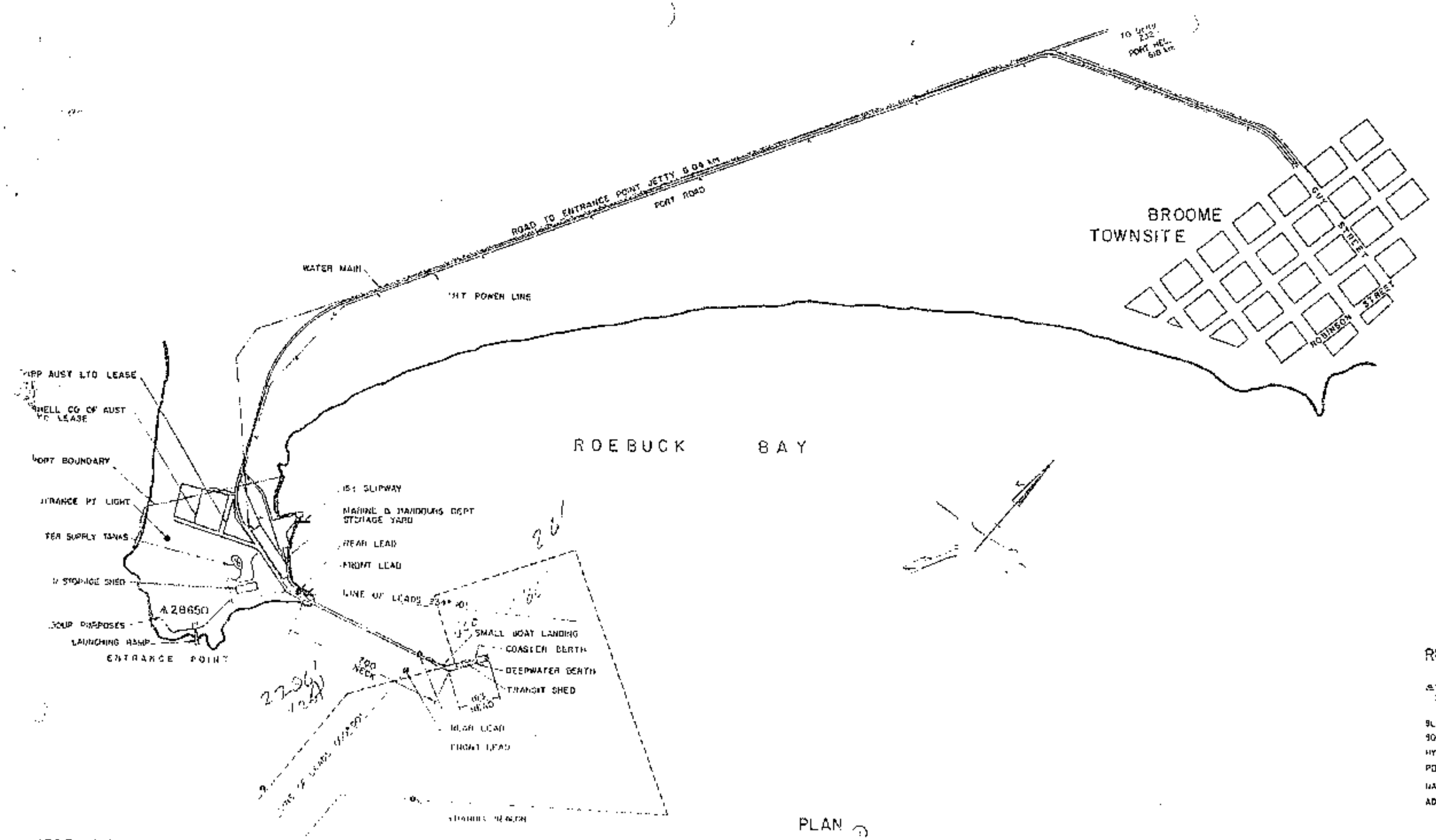


BHP iron ore ship loading facility at Koolan Island, Yampi Sound 1960

BHP iron ore ship loading facility at Cockatoo Island, Yampi Sound 1

The Port of Broome – Roebuck Bay 2008   google earth

PORT OF BROOME
LOCALITY PLAN



PLAN ①

REFERENCE PLANS

	PWD., WA
JETTY	
FENDERING (OUTER BERTH)	44084 / 53879
(INNER BERTH)	44084
SLIPWAY - 151	40830
SOUNDINGS (1979 ONWARDS)	51883
HYDROGRAPHIC SURVEY (1968)	44593
PORT BOUNDARY	39143
NAVIGATION AIDS	42429
ADMIRALTY CHARTS	AUS 50, 324 BA 1048

0 100 200 300 400 500 600 700
SCALE OF METRES ① (1:20000)

PORT INFORMATION

POSITION
LAT 18°00' S, LONG 122°..' E

DATUM
CHART DATUM WHICH IS ... BELOW ... AHD

ACCOMMODATION
[illegible]

IMPORTS
GENERAL CARGO

EXPORTS
FROZEN MEAT, ... LIVE CATTLE

CARGO HANDLING
[illegible]

FRESH WATER
AVAILABLE FROM ... BERTHS

OIL SERVICE POINTS
[illegible]

ELECTRICAL SERVICES
[illegible]

ROAD SERVICES
CONNECT THE JETTY WITH BROOME AND THE HINTERLAND OF THE SOUTHERN KIMBERLEY AND NORTH WEST

PORT OPERATING AUTHORITY
DEPARTMENT OF MARINE AND HARBOURS, FREMANTLE

TIDE DATA
[illegible]

PILOTAGE
[illegible]

METEOROLOGICAL DATA
[illegible]

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF BROOME
LOCALITY PLAN AND SERVICES DATA

SCALES AS SHOWN — AS SHOWN

P.W.D. W.A. 53923-4-1

04 Broome

Early History

Roebuck Bay became an anchorage and landing for the pearl fishing in the 1870s, with the township of Broome being proclaimed in 1883.

In 1896 J Wishart & Son built a timber jetty at Mangrove Point 2953 feet long and 15 feet wide with a head 340 feet long by 30 feet wide, with cattle ramp and yards, a goods shed and a 2'-0" gauge tramway with a branch to Streeters private jetty. Tenders were called for leasing this jetty and tramway in 1898, and leading lights were established: in 1900 when the stock rails which had been damaged by white ants were repaired.
The tramway was re-laid with 45 lb rails and converted to 3'-6" gauge in 1908, and the port was described as being the headquarters of the pearling fleet and also the principal cargo port for the North-West. It had a large jetty, although tidal, cattle yards and a tramway and ships called fortnightly on voyages between Fremantle and both Singapore and Wyndham. The tramway \vas operated by horses until 1910 when a steam locomotive was used

Harbour Development 1960s

Apart from the continual maintenance of the timber Jetty at Mangrove Point there was very little port activity between 1950 and 1965 until 1965/66 when a steel tubular piled Jetty with a steel and concrete deck was constructed at Entrance Point, four miles south west of the existing timber jetty.
The $3,200,000 steel and concrete, deepwater~ jetty extended 2,896 ft. north-eastwards into Roebuck Bay from Entrance Point, a natural promontory 4 miles southwest of the town.

The project was financed jointly by the Commonwealth and State Governments under an agreement dated October 24th, 1963.
Construction began in February, 1964, and was completed in July, 1966. with the jetty being opened by Premier David Brand on 23rd July 1966.

The Resident Engineer for the project was Des Kelly assisted by assistant engineer Mike Paul and the Engineer for Harbours and Rivers was NJ Henry who was succeeded by JD Gillespie. in 1965.

A well defined entrance channel led to protected berths approachable in all tides on either side of the jetty's 600 ft. long berthing head.
Although spring tides range up to 27 ft., the berths had minimum depths at low tide of 32 ft. and 28 ft. respectively.
A flexible fendering system of steel piles and rubber buffers protected

the jetty from berthing shocks.
The 85 ft. wide concrete deck of the berthing head which was 39 ft. above low water mark was supported on tubular steel piles.
An impressed current, cathodic protection system with automatic current control protected below water steel from corrosion. All steel above water was protected by special zinc based and plasticised tar paints.
A transit shed and Wharfinger's office 300 ft. long and 35 ft. wide was centrally placed on the berthing head leaving a 25 ft. apron between shed and ship on either side.
The jetty was illuminated for night working by incandescent, high efficiency lanterns and a bank of flood lights at either end of the transit shed on 60 ft. high steel towers. Electricity was supplied from the town supply of 250 volts 50 cycle A.C..
The 2,296 ft. long approach neck was 27 ft. wide.
Ancillary works inshore included a lumpers' amenities building and a security fenced goods yard with workshops' for servicing cargo handling equipment cargo handling equipment includes fork-lift trucks, a 10 ton and two 5 ton mobile cranes.
In 1973/74 an amenities building was provided on the jetty and a contract was completed by Freighter Industries for the installation of two freezer units for handling perishable cargo on the Jetty. An extension of the existing cargo shed on the Jetty to provide additional offices for the Harbour and Light Department was also completed that year.
Between 1975 and 1977 the 30 tonne capacity slipway cradle near the Entrance Point Jetty was rebuilt and the replacement of some of the outer berth fender units commenced.

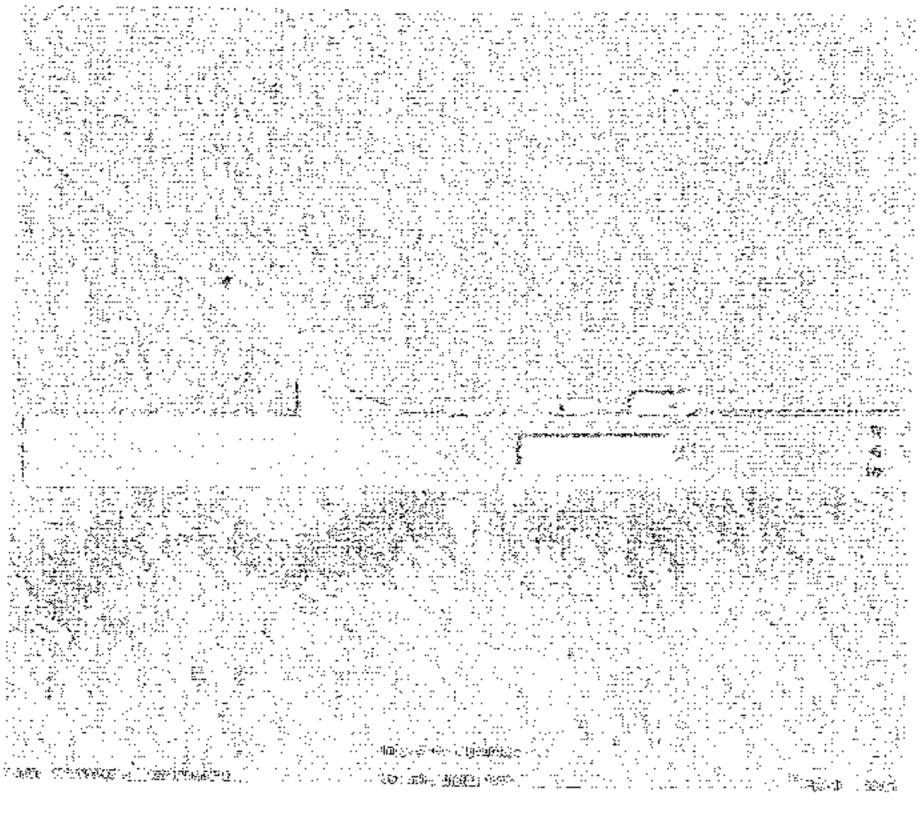
In 1979/80 a feasibility study was carried out for the installation of bulk loading facilities on Broome Jetty.

Between 1980 and 1982 a bulk loading installation, designed by Consulting Engineer Kieth Dodd, comprising a 16,000 tonnes capacity grain storage shed on shore, a weighbridge and a 300 tph transportable jetty ship loader was completed, The Site Engineer was Mike Rogers and the Engineer, Harbours and Rivers was MG Anderson.

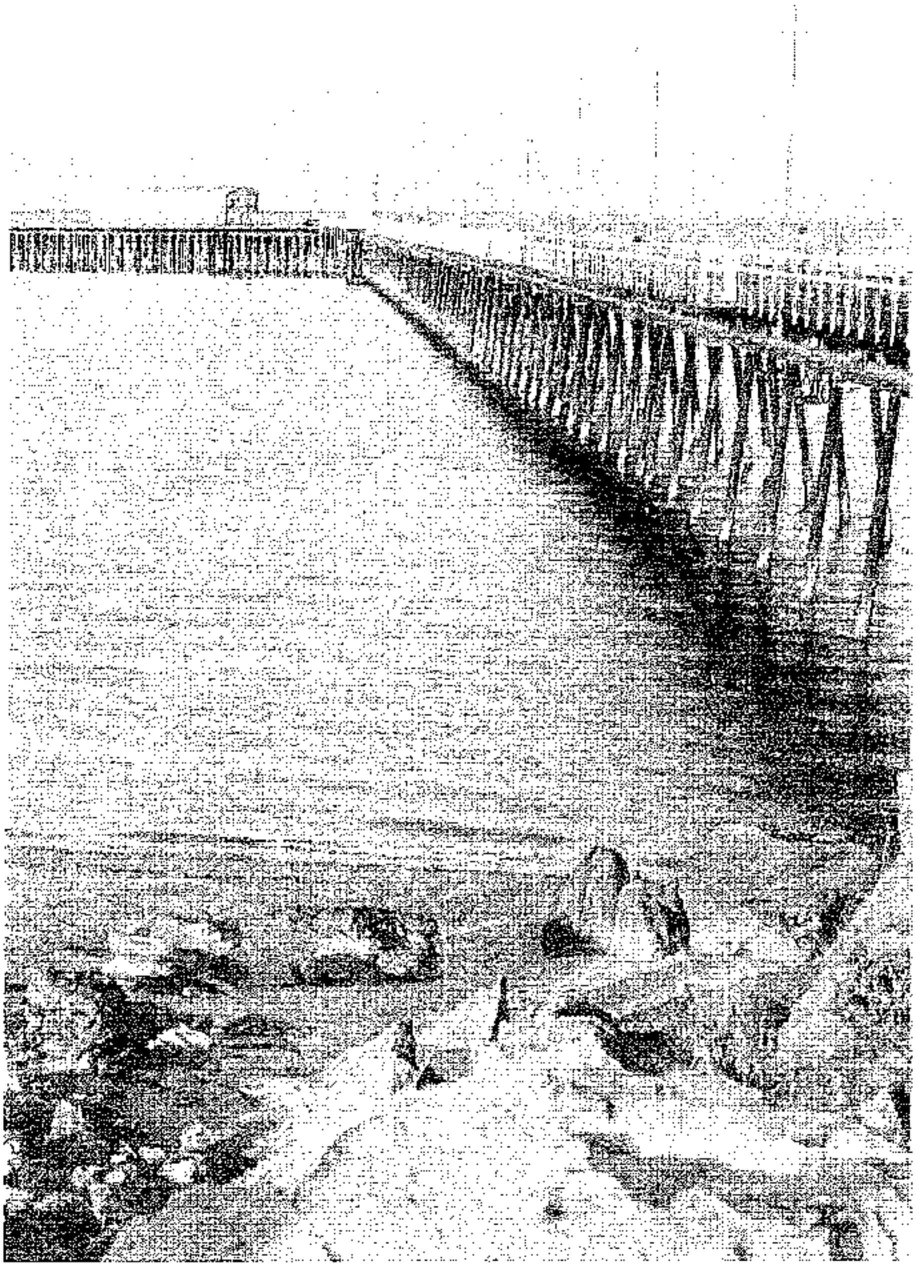
A major reconstruction of the outer berth fender system was completed and drainage and road works at the bulk storage facilities were carried out in 1983.

A new public boat launching ramp was constructed in 1982/83...

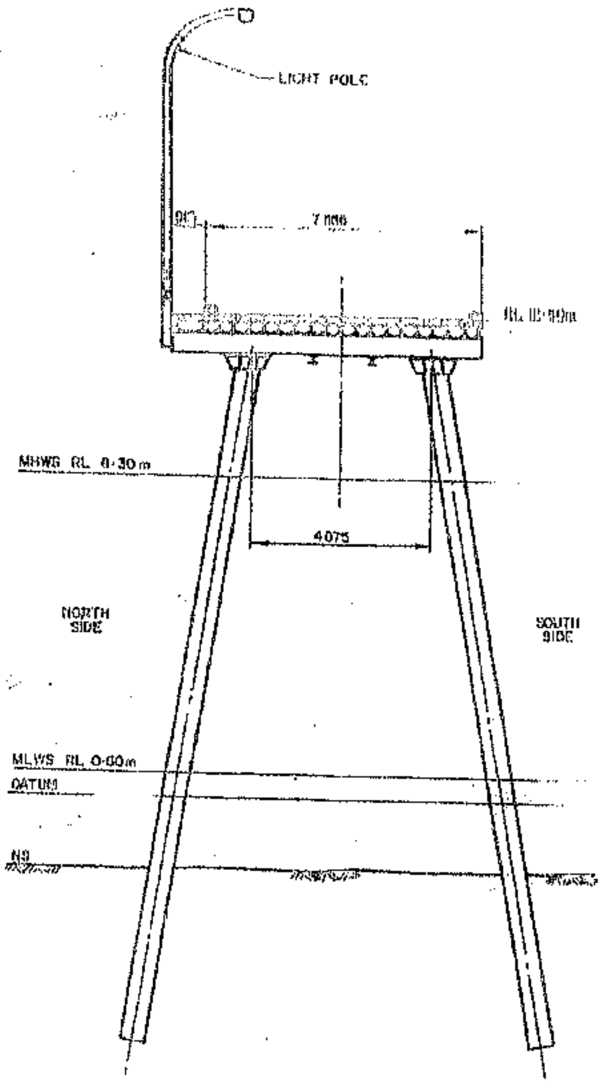
The 1966 Broome Jetty showing the 2,296 feet length neck and the 1966 head and the southern extension of the head in 2006, which was carried out by the Broome Port Authority



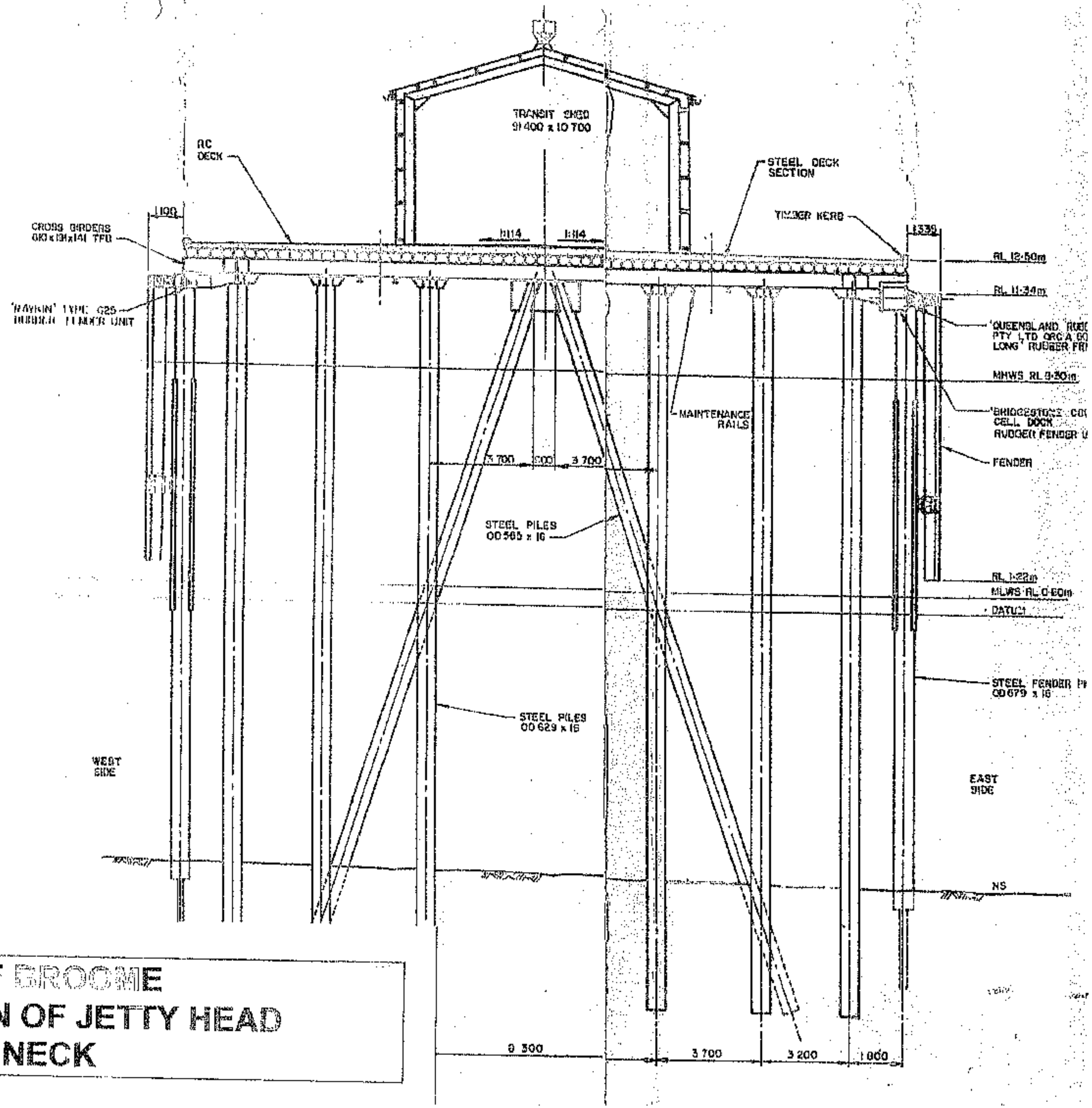
Brome Jetty showing the 2006 extension on the left and the transit shed on the right.



Broome Jetty at Entrance Point taken shortly after completion in 1966

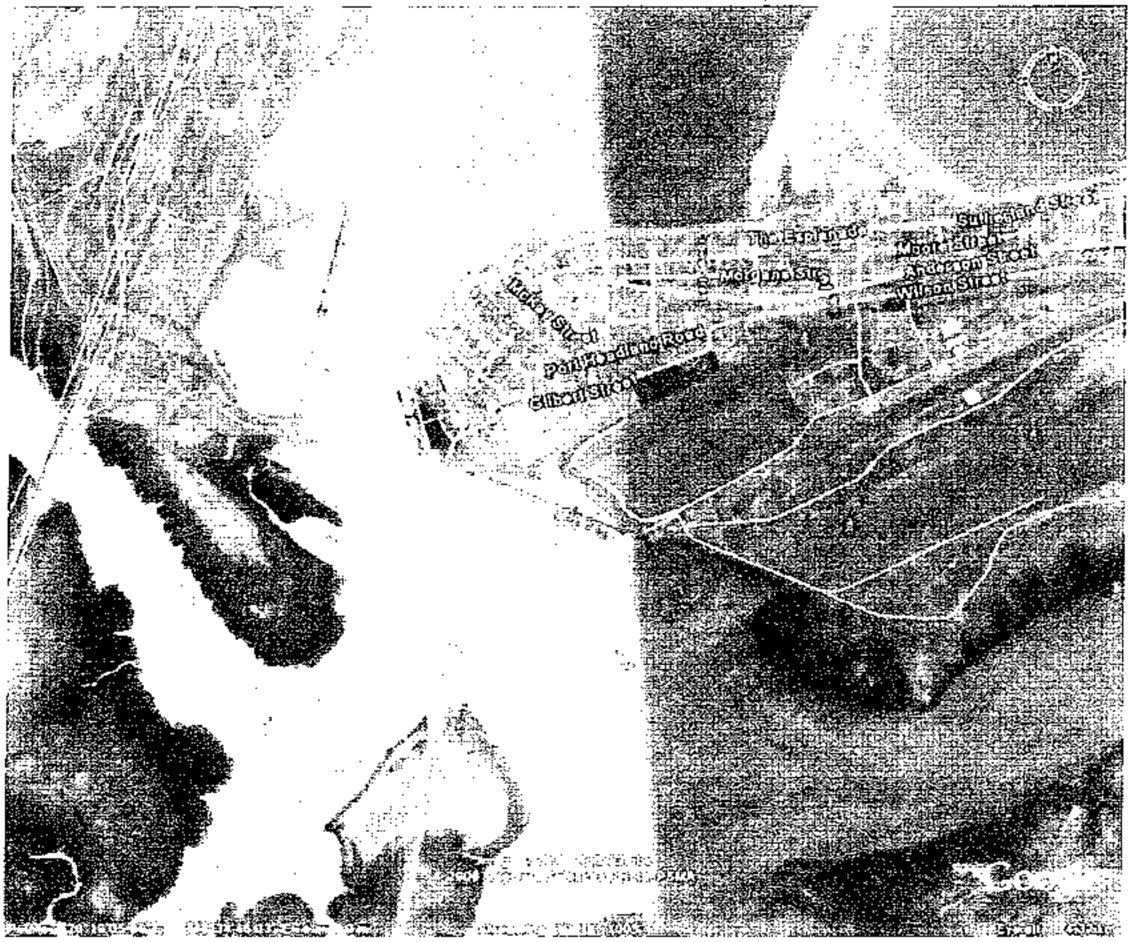


CROSS SECTION THROUGH NECK (1)
(PIERS AT 9 145 CENTRES)



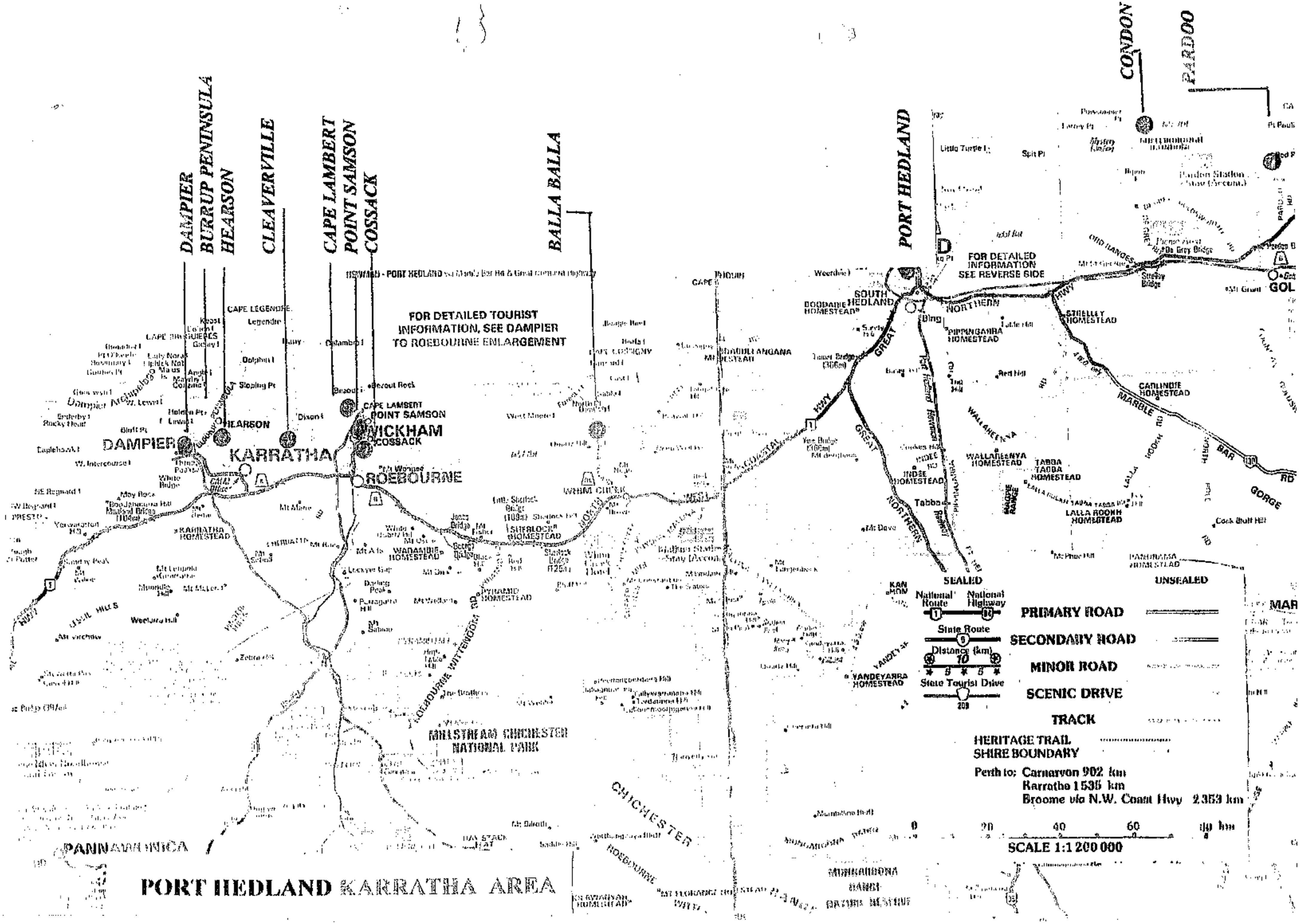
PORT OF BROOME
CROSS SECTION OF JETTY HEAD AND NECK

Pilbara



Port Hedland Port 2007 *google earth*

From left to right – Mount Goldsworthy ore loading berths on Finucane Island (top left). Fortescue Metals development at Anderson Point (lower off centre), Port Authority general berths, Leslie Salt export berths and ore loading berths and iron ore stockpiles for Mount Newman (top right to middle right).


DAMPIER
BURRUP PENINSULA
HEARSON
CLEAVERVILLE
CAPE LAMBERT
POINT SAMSON
COSSACK
BALLA BALLA
PORT HEDLAND
CONDON
PARDOO
FOR DETAILED TOURIST INFORMATION, SEE DAMPIER TO ROEBOURNE ENLARGEMENT
FOR DETAILED INFORMATION SEE REVERSE SIDE
KARRATHA
ROEBOURNE
WICKHAM
SOUTH HEDLAND
MILLSTREAM CHICHESTER NATIONAL PARK
CHICHESTER
PANNAWONICA
SEALED
UNSEALED
National Route
National Highway
PRIMARY ROAD
State Route
SECONDARY ROAD
Distance (km)
MINOR ROAD
State Tourist Drive
SCENIC DRIVE
TRACK
HERITAGE TRAIL
SHIRE BOUNDARY
Perth to: Carnarvon 902 km
Karratha 1535 km
Broome via N.W. Coast Hwy 2353 km
SCALE 1:1 200 000
PORT HEDLAND KARRATHA AREA

05 Port Hedland

Early History

Historically there have been seven landing places and anchorages in the Pilbara including Port Hedland. - (nine if Pardoo Landing and Banningarra Creek north east of Port Headland are included.)

Dampier

Dampier or Hampton Harbour located in Nichol Bay was the site of a pearling port in 1875. Other shelters were Hearson Cove on the west side of the bay and Cleaverville on the south side of the bay.

Cossack

Cossack originally known as Tien Tsin Harbour in Butchers Inlet was gazetted as a port in 1872 with a jetty and wharf being built at Cossack in 1875. It became a very important pearl fishing centre up to until the 1890s when Broome took over as the pearling centre for the north,, In 1900 as the result of large sand movements, the harbour silted up. In the 1950s the town was abandoned.

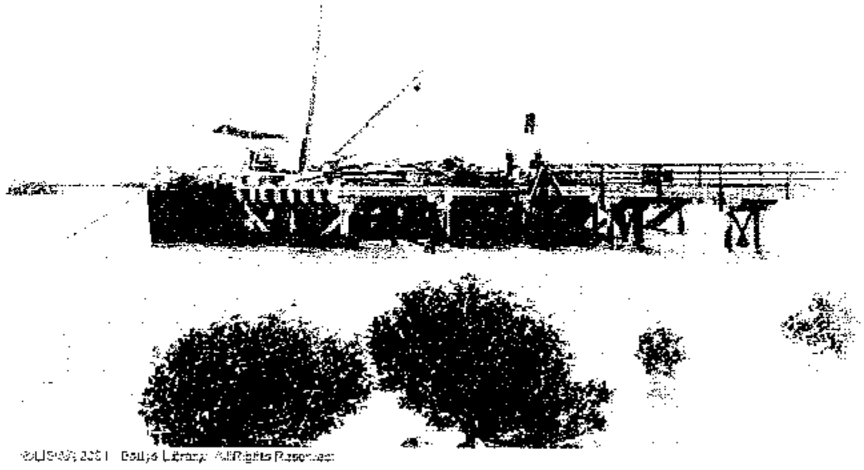
The corner of the abandoned Cossack Rock wall wharf in Butchers Inlet 1990

Point Samson

In 1904 Point Samson took over from Cossack when a 1816 feet length jetty with a 281 feet length head was built 4 miles north of Cossack to serve the Roebourne area.

Balla Balla

In 1878 the Balla Balla Landing between Point Samson and Port Hedland became the port for the exporting of sheep and copper ore from Whim Creek... In 1896 a 275 feet length jetty with a 97 feet by 20 feet width head was built in Balla Balla carrying a 2'- 0" gauge tramway and connected to the new town of Whim Creek by a causeway over the tidal marsh.



Balla Balla Jetty 1898

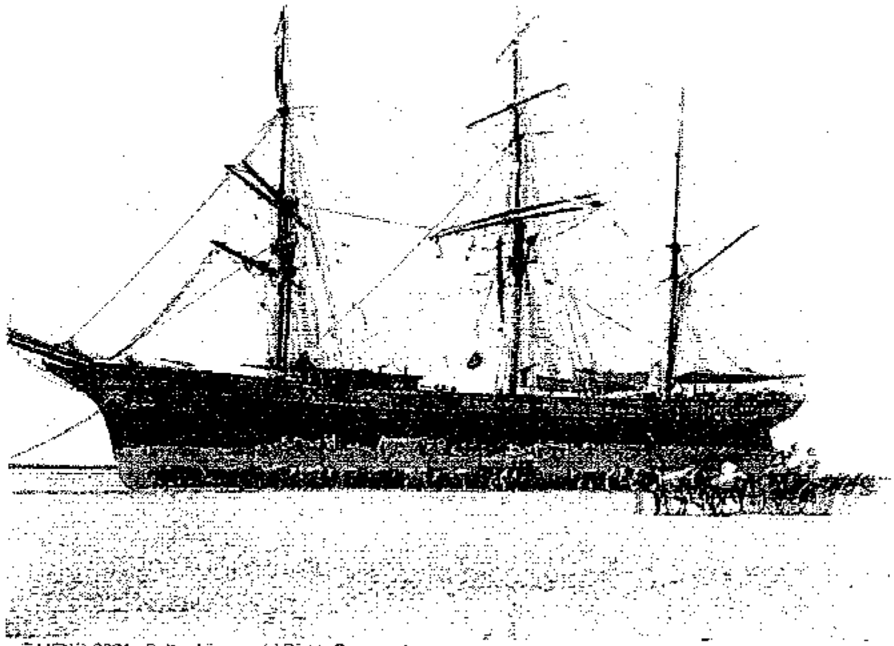
In its heyday, the town of Whim Creek had several pubs, a Post Office, Bakery and a Police Station and a population of 400, 130 of whom worked in the town's copper mine - once the biggest in the North West.

In earlier years the ore was carried 20km to the small port of Balla Balla on a railway line. Sails were attached to the loaded rail wagons, in order to use the trade winds that blow during much of the year. The jetty at Balla Balla was used until the decline of the copper mine in the 1930's and was finally blown away by a cyclone in 1956. The mine was worked on and off until the 1960's when it was finally abandoned.

Condon

Condon Creek, east of Port Hedland, about 12 miles east of the mouth of the De Grey River was an important landing point for wool from De Grey and other stations.

Plans for a jetty were prepared in 1896 but were cancelled, although the bond store was built in that year. (It was moved to Broome later) and only the foundations remain today.) The jetty and a short tramway to the post office, were built in 1898 /1899, The township then had a population of 200, but this had dwindled to twelve residents by 1905.



The 959 tons barque Arabella loading wool circs 1900

Port Hedland

In 1867 the landing at Port Hedlamd, previously named Mangrove Harbour, became a landing point for settlers and pearlers and a point of entry for the Pilbara Goldfield. In 1897 the first jetty was built in the harbour. In 1909 a second jetty was constructed for the railway to Marble Bar, At that time the port was described as having a substantial jetty and that it was a major port for the Pilbara Goldfield (Marble Bar and Nullagine), the Woodgina Tinfield and for the export of cattle. The 3'- 6" gauge 114 mile length railway to Marble Bar was commenced in 1909 and completed in 1911.

Apart from continual maintenance to the 1909 timber jetty very little improvements were carried out to the port, apart from revamping the existing jetty on 1957 to provide two 350 feet length berths, one for manganese and one for general cargo.

Harbour Development 1960s

In 1967 a contract was awarded to PDC Constructions Pty Ltd for a sum of $ 2,562,720 for the construction of a 600 feet length land backed berth to handle general cargo, the export of salt and the import of mining equipment for the Mt Newman Mining Company. The new berth, which was completed in August 1968, was opened by the Minister for Works on February 18th 1969

The resident engineer supervising the contact was Mike Paul and the Engineer for Harbours and Rivers was JD Gillespie.

The design of the structure was not dissimilar to No.4 Berth at Geraldton. It consisted of tubular steel piles, steel cross girders and longitudinal beams and a reinforced concrete deck. Rubber fender units were provided. Rails were incorporated in the concrete deck for the travelling salt loading gantry. A transit shed 290 feet long and 60 feet wide was located at the rear of the wharf apron. A rock stabilising wall at the back of the wharf was considered to be better suited to the prevailing conditions than the alternative of steel sheet piling.

Before the berth was completed, and by special agreement between the parties, several ships berthed to unload cargoes which would have been too heavy to unload elsewhere at Port Hedland... The berth was designed to accommodate vessels of 45,000 dead weight tons with a draft of 37 feet. The loading facilities on the wharf were able to load salt at a rate of 1500 tons per hour.

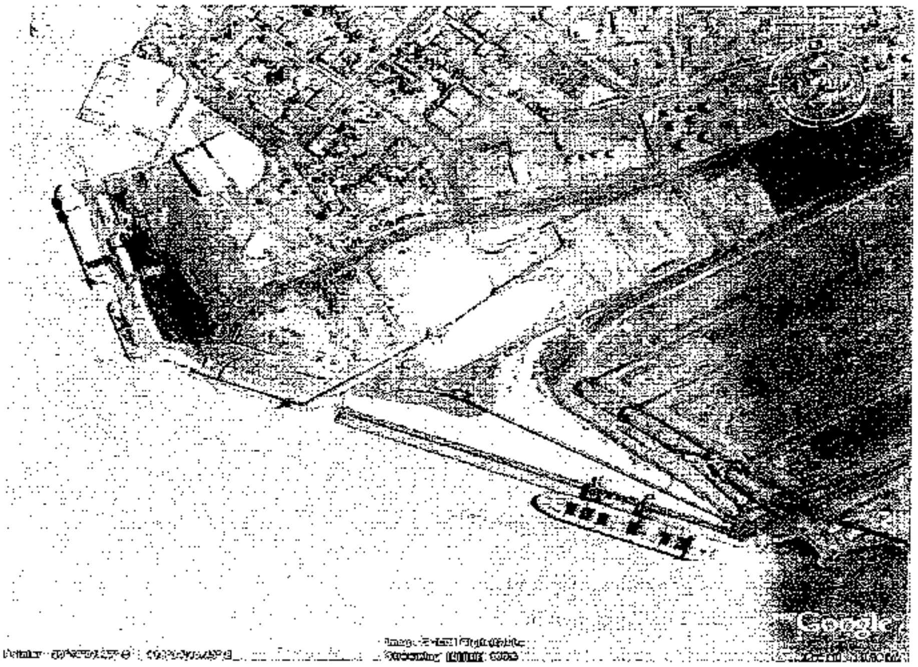
In 1970 as an extension of the Utah dredging contract with Mount Newman Mining Company, the dredging of a further 347, 00 cubic yards of material from the harbour for the site of the second land backed berth was completed, together reclaiming of eight acres of land and stockpiling for a further three acres at the second land backed berth site.

The building of a new air conditioned Waterside Workers' mess, ablution block and other amenities was also completed. The deck of the first land backed berth, constructed initially for the handling of equipment for the Mount Newman Mining Company and the export of salt by the Leslie Salt Company was strengthened by the placing of additional underdeck steel beams.

In December 1971 a contract awarded to Toodyay Stone for building a rock wall behind the site of the second Port Hedland land backed berth was completed in November 1972. The north arm of the timber jetty was removed in February 1973 to make way for the new berth and tenders were called for the construction of the second landbacked berth, designated Berth No 1, with the contract being awarded to Taylor Woodrow International in April 1973 for the sum of $1,347, 286. The contract was successfully completed and the berth became operational in August 1974. The resident engineer supervising the contract was Mike Paul and the Engineer, Harbours and Rivers was MG Anderson.

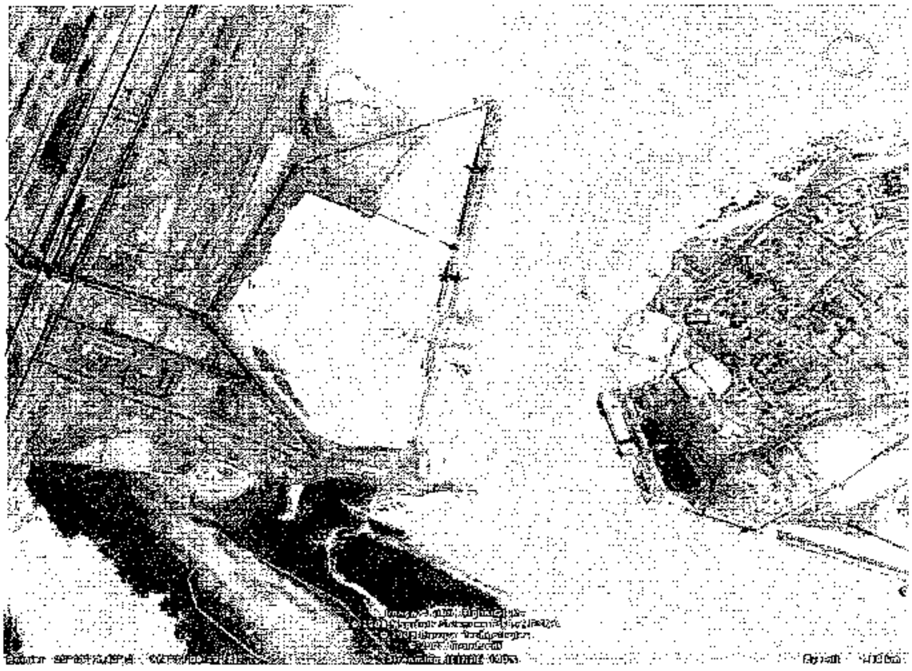
The berth followed the style which by that time was becoming quite familiar, a flat slab or plate of reinforced concrete surmounting tubular steel piles which were spaced at 4.9 metre centres in the piers which were 4.57 metres apart. The berth apron was 22.5 metres wide and was connected to the land fill by three approach ramps. The fendering system utilised timbers supported on steel piles with rubber fender units cushioning the load to the main structure. The berth was designed to take the heavy lifts of machinery and rolling stock associated with mining activities in the area.

Following the completion of this berth A further contract was awarded to Westham Dredging for the maintenance dredging of the harbour basin and part of the approach channel

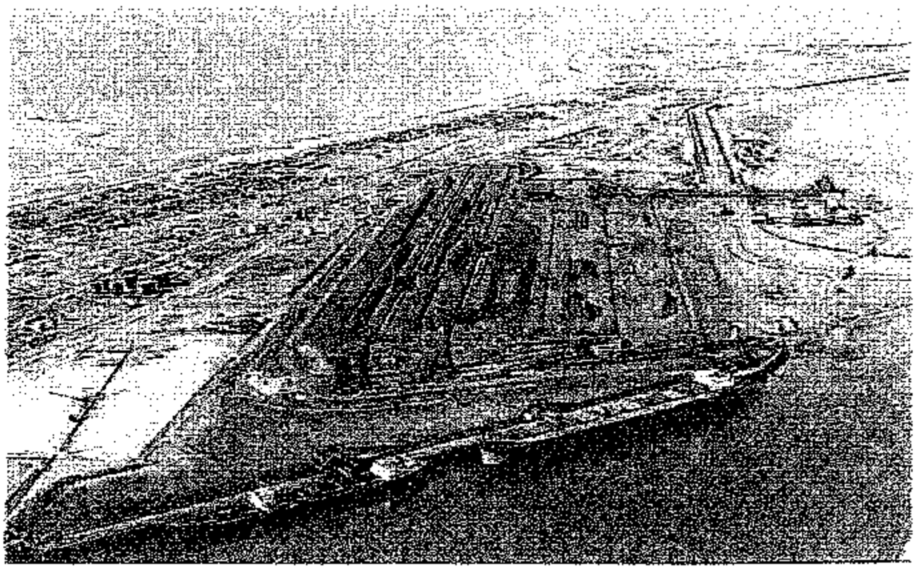


Part of Port Hedland harbour 2007, showing the No berth, built by Taylor Woodrow on far left, the No 2 "Salt " berth built by PDC Constructions and the Mount Newman iron export berths. Note the salt piles behind No 2 berth and the iron ore stockpiles behind the Mount Newman berths. *google earth*

In 1966 bulk exports of iron ore from Mount Goldsworthy commenced over a new land-backed berth on Finucane Island and exports of salt over the new harbour berth No 3 began in 1969. New berths were built at Nelson Point between 1971 and 1974 for loading iron ore from Mount Newman and a second ore-handling facility was opened on Finucane Island for Mount Goldsworthy in 1976.

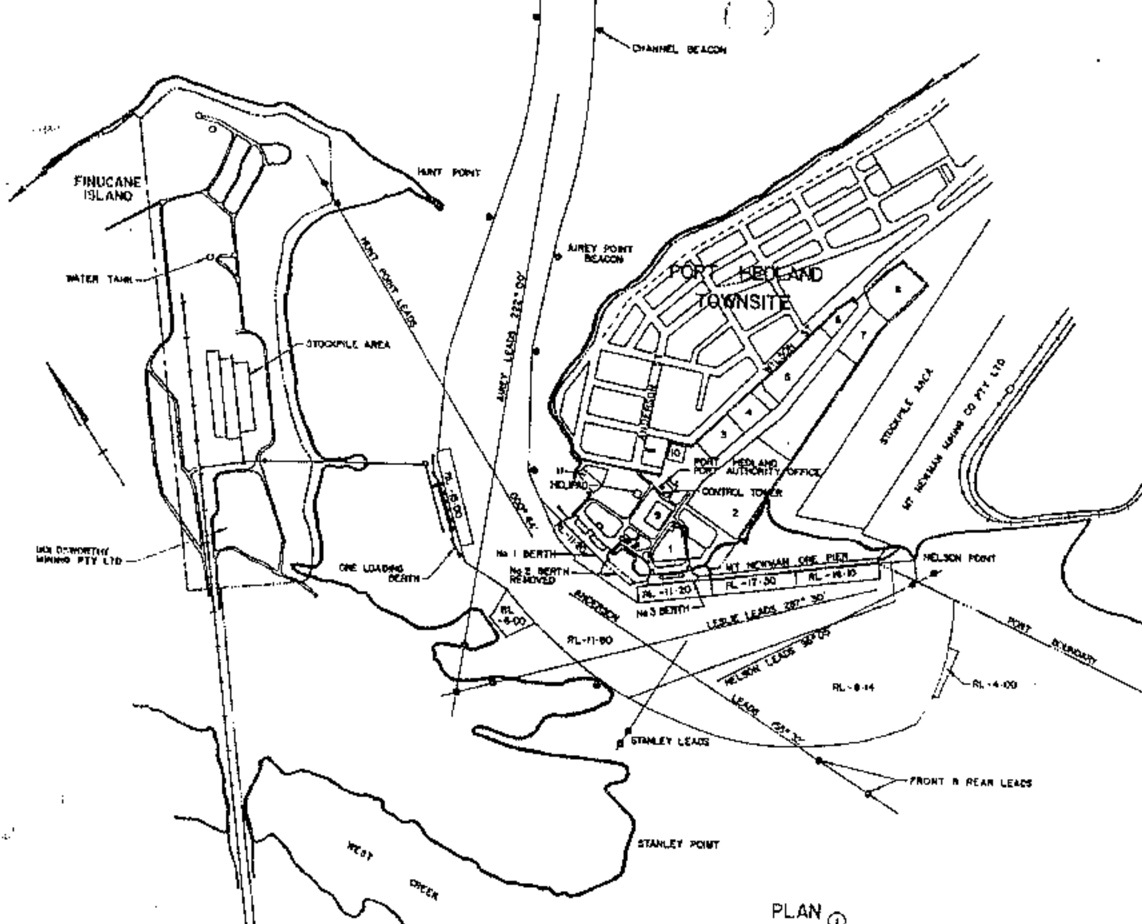


The Mount Goldsworthy two iron export berths on Finucane Island on the left with the salt export berth No 3 on the right google earth



The two Mount Newman iron ore loading berths at Nelson Point showing the port stockpile areas and the ore rail unloading area on the far right. The salt stockpile area immediately behind No 3 berth (not shown) is on the far left.

PORT OF PORT HEDLAND
LOCALITY PLAN

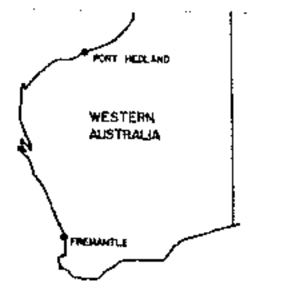


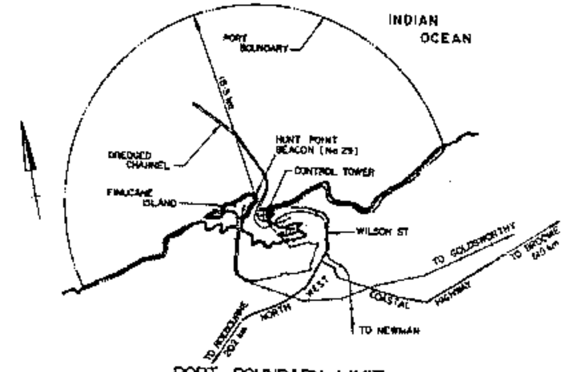
PLAN ①

PRIVATE LEASE AREAS WITHIN PORT BOUNDARY

1. DRESSER
2. LESLIE SALT CO
3. MOBIL OIL AUST LTD
4. AMPOL PETROLEUM LTD
5. BP AUST LTD
6. GOLDEN FLEECE PETROLEUM
7. CALTEX OIL (AUST) PTY LTD
8. SHELL CO OF AUST LTD
9. P & O AUST LTD
10. SEAFARER'S CENTRE
11. BRAMBLES HOLDINGS LTD

FOR OTHER LEASES NOT SHOWN ON DRG, SEE PORT HEDLAND PORT AUTHORITY, WA, ANNUAL REPORT





PORT BOUNDARY LIMIT ②

PORT INFORMATION

POSITION
[illegible]

DATUM
CHART DATUM WHICH IS [illegible] BELOW AHD

ACCOMMODATION
[illegible]

IMPORTS
PETROLEUM PRODUCTS & GENERAL CARGO

EXPORTS
MINERAL ORES OF IRON, MANGANESE & COPPER, SALT, WOOL AND SHEEP.

CARGO HANDLING
ON No 1 & No 3 BERTHS BY STERN LIFTS ON AND OFF ROAD TRANSPORT [illegible] LIFTS AND TWO [illegible] AVAILABLE (DETAILS PROVIDED ON APPLICATION TO PORT HEDLAND PORT AUTHORITY)

FRESH WATER
AVAILABLE AT No 1 & No 3 BERTHS

OIL SERVICE POINTS
PROVIDED FOR PETROLEUM PRODUCTS FROM No 1 & No 3 BERTHS (BUNKERING FROM No 1 BERTH DIESOLEUM ONLY)

ELECTRICAL SERVICES
POWER AND LIGHTING SUPPLY AT 440/250V 50Hz. FLOODLIGHTING IS PROVIDED FOR NIGHT WORKING. No 1 BERTH HAS 6 x 150A 3 PHASE 440V 50Hz OUTLETS, 6 x 20A 3 PHASE 440V 50Hz OUTLETS AND 6 x 10A SINGLE PHASE 250V 50Hz OUTLETS INSTALLED ALONG BERTH FACE. No 3 BERTH HAS 30A 3 PHASE 440V 50Hz POWER OUTLET SOCKETS INSTALLED ALONG BERTH FACE FOR SUPPLY TO HOLD FANS AND SIMILAR APPARATUS. DISCHARGE OF FLAMMABLE CARGO AT NIGHT IS POSSIBLE BY SPECIAL ARRANGEMENT WITH THE HARBOUR MASTER.

ROAD SERVICES
ROAD ACCESS PROVIDED TO BOTH BERTHS.

PORT OPERATING AUTHORITY
PORT HEDLAND PORT AUTHORITY.

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED, PREDICTIONS ARE AVAILABLE.

PILOTAGE
PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER.

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATION - 'CLIMATIC SURVEY' - NORTHWEST - REGION 6 - WESTERN AUSTRALIA.

REFERENCE PLANS	PWD., WA
No 1 BERTH	47065
No 3 BERTH	43776
CHANNEL AND BERTH SOUNDINGS (1975)	47928
HYDROGRAPHIC SURVEY (1975 ONWARDS)	49236
FUTURE PORT DEVELOPMENT	43641
PORT BOUNDARY	39148
LEASES WITHIN PORT BOUNDARY	42082
NAVIGATION AIDS	44185
ADMIRALTY CHARTS	AUS 53, 54 & 328 BA 1048, 1055

5000 0 5000 10000 15000
SCALE OF METRES ② (1:500 000)

100 50 0 100 200 300 400 500 600 700
SCALE OF METRES ① (1:20 000)

GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES
1. SEE [illegible] 53923-5-2 FOR CROSS SECTIONS AND DESIGN LOADINGS.

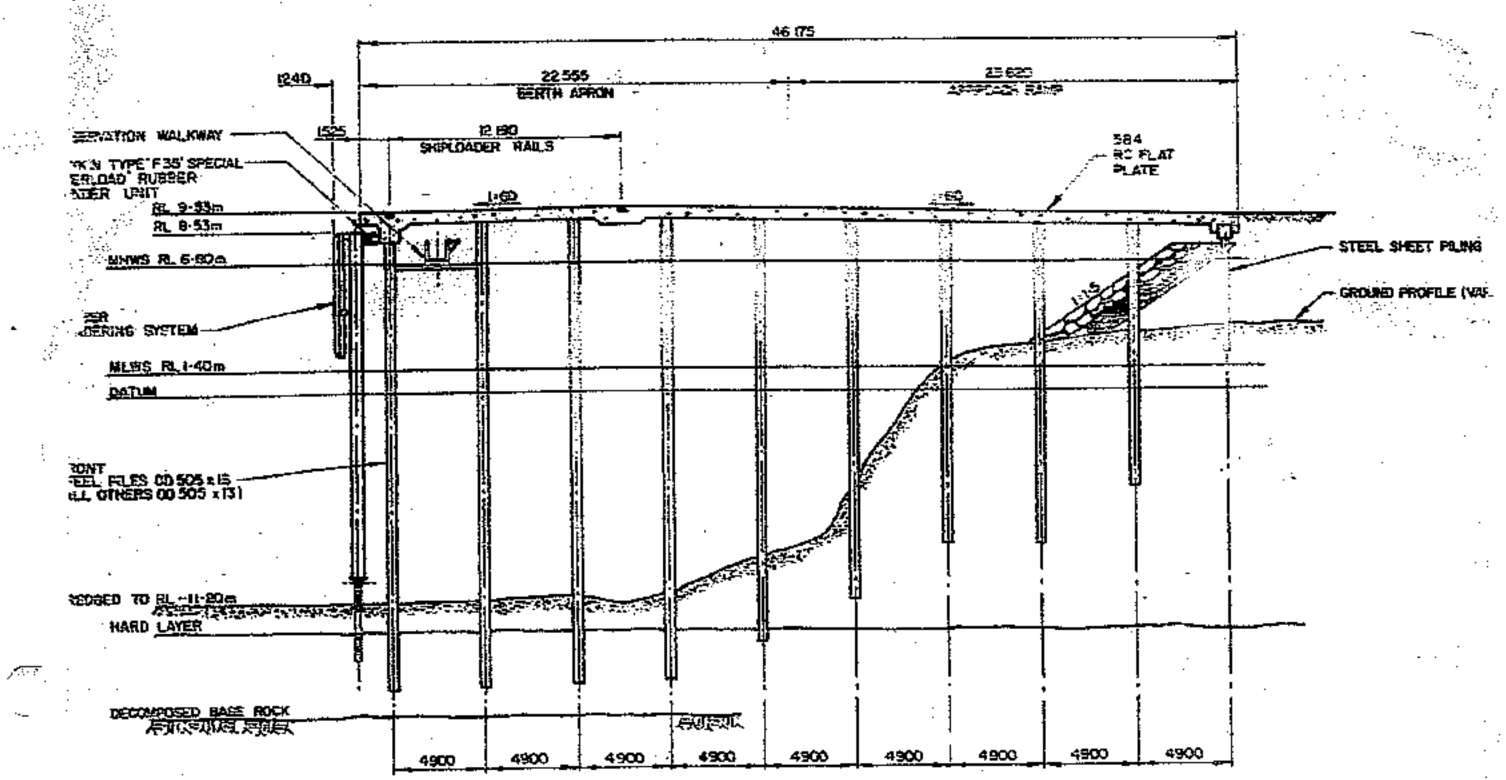
REVISED TO DEC 31, 1982

SCALES AS SHOWN
MICROFILMED
DATUM
AS SHOWN

DESIGN CALC. BOOK
CHECKED BOOK
DRAWN PJ3 CHECKED CS/JMS
TRACED CHECKED
SUPERVISING DESIGN ENGINEER HBR
SUBMITTED DATE 28.12.?
APPROVED DATE 24.1.79

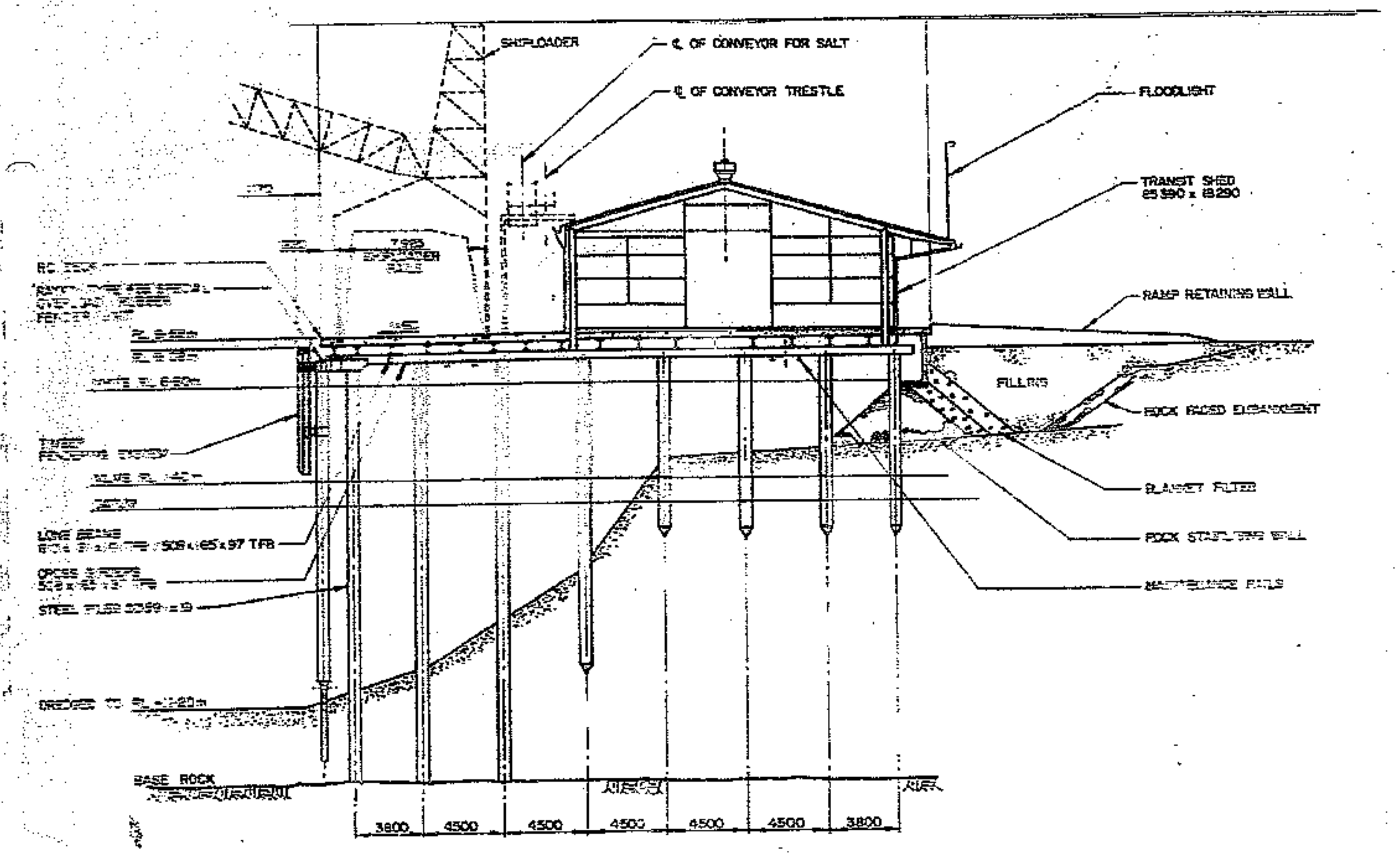
PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF PORT HEDLAND
LOCALITY PLAN AND SERVICES DATA

P.W.D. W.A. 53923-5-1



No 1 BERTH TYPICAL SECTION
(PIERS AT 4 570 CENTRES)

PORT OF PORT HEDLAND
CROSS SECTIONS OF BERTHS



No 3 BERTH TYPICAL SECTION
(PIERS AT 7 315 CENTRES)

Port Hedland Harbour Development
Idioms

In the initial dredging of the Port Hedland harbour basin and approach channel the crews working on the dredges were of mixed race, creating some problems when it came to communication.

Safety was of prime importance and it was necessary that signals given were clearly understood by the dredge crews. Unfortunately our Australian idiom does not always convey the right message. The expression "look out" is meant to be a warning like watch your step, take care, stand back etc.

So what did an Aussie worker call out when working on one of the upper decks of one of the dredges when a shackle pin slipped from his grasp to bounce along the deck and over the rail passing the deck below?

He called out " Look out down below " - and one of the Japanese crew members down below just did that - he looked out over the rail and was hit on the back of his head with a glancing blow as the pin plummeted past.

06 Point Samson

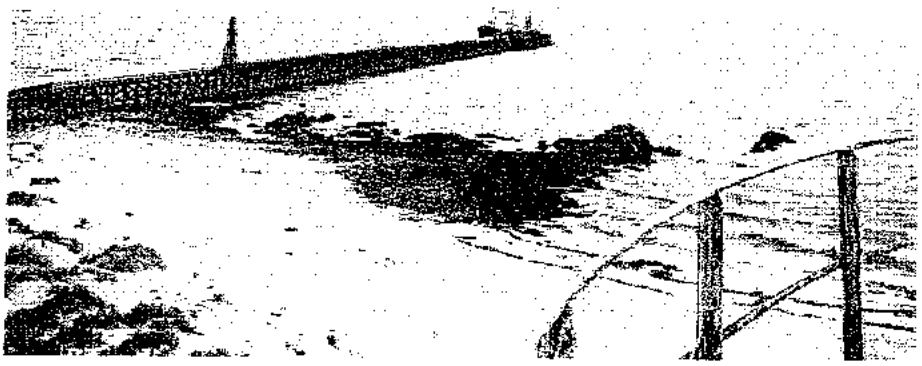
Early History

The original 1904 Jetty at Point Samson was almost completely destroyed by a cyclone in 1925. A second Jetty, 2,267 ft long, which was built on the same site between 1936 and 1937. was officially opened by the Minister for the North West on Feb 7 1938. Due to teredo worm action and cyclones pile replacements were a continuous programme. Between 1950 and 1970 every pile in the structure had been replaced at least once

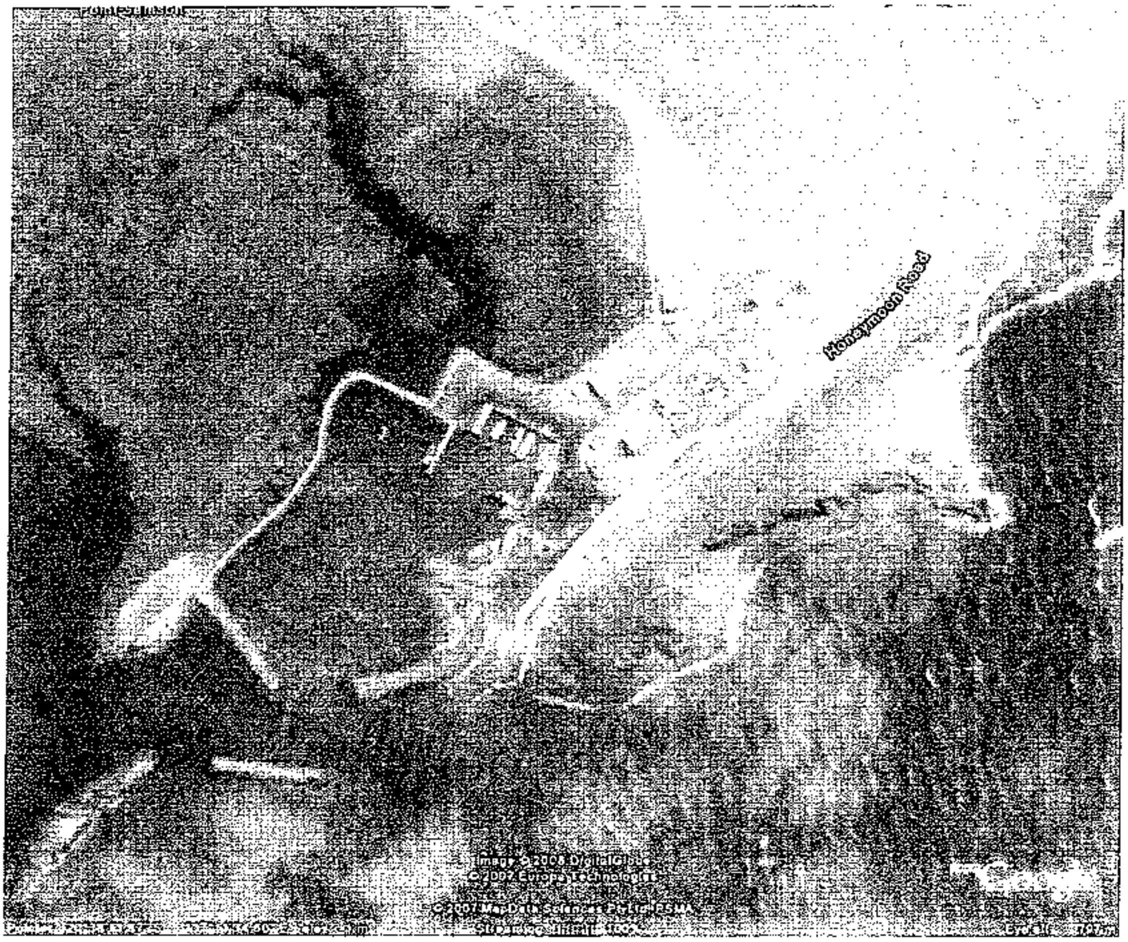
In 1970. /71 the maintenance of the old timber jetty continued whilst consideration was being given to the possible replacement of the Jetty adjacent to the present one or else at Phillip Point near Dampier,

In 1972/73 an amenities building was provided on the Point Samson Jetty and the power supply to the port area was upgraded.

With the development of the iron ore export port at Cape Lambert, cargo handling was eventually transferred from Point Samson to private facilities at Cape Lambert, and by 1975 the Point Samson Jetty was closed to commercial shipping.



The very much exposed Port Samson timber jetty taken in 1961 prior to being devoured by teredo worms and cyclones.



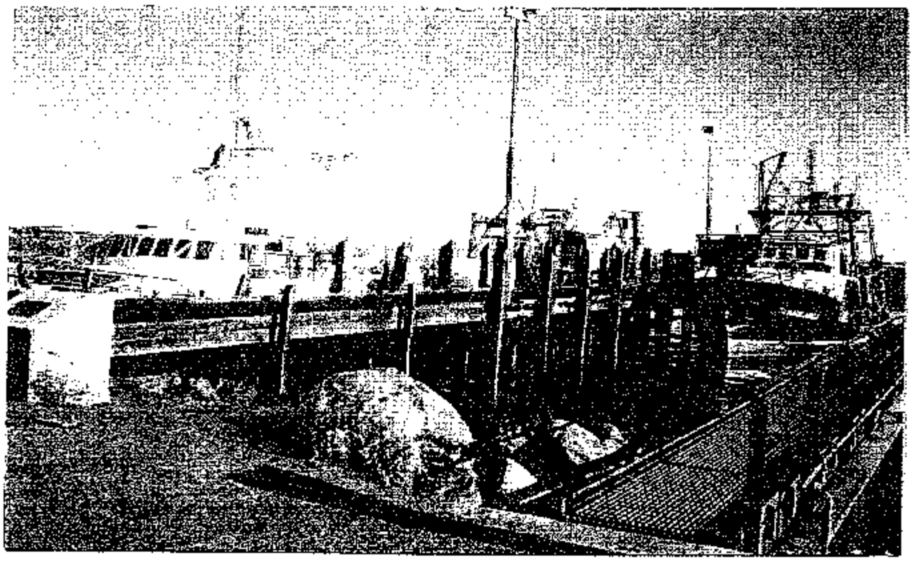
Point Samson Johns Creek, Small Boat Harbour

2007

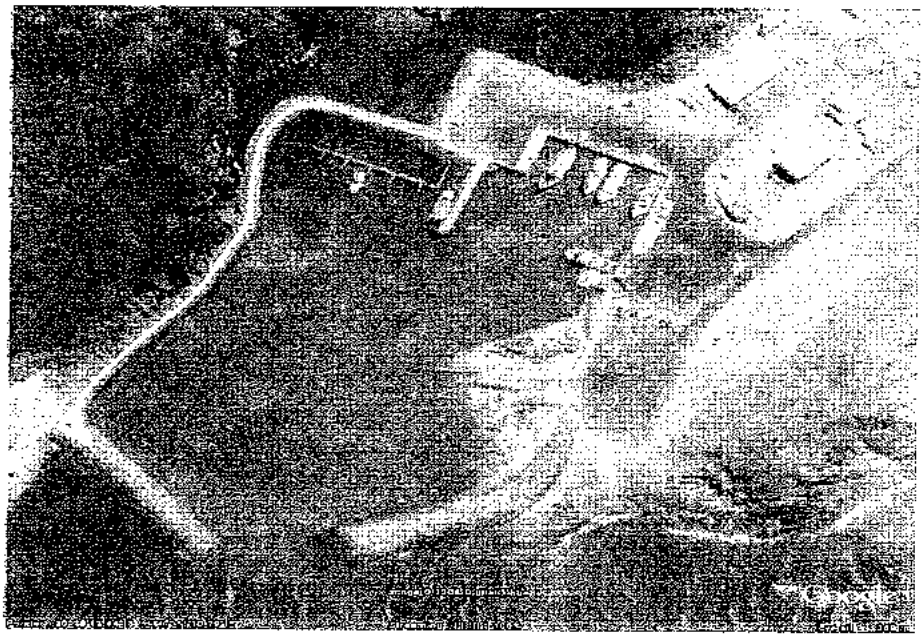
google earth

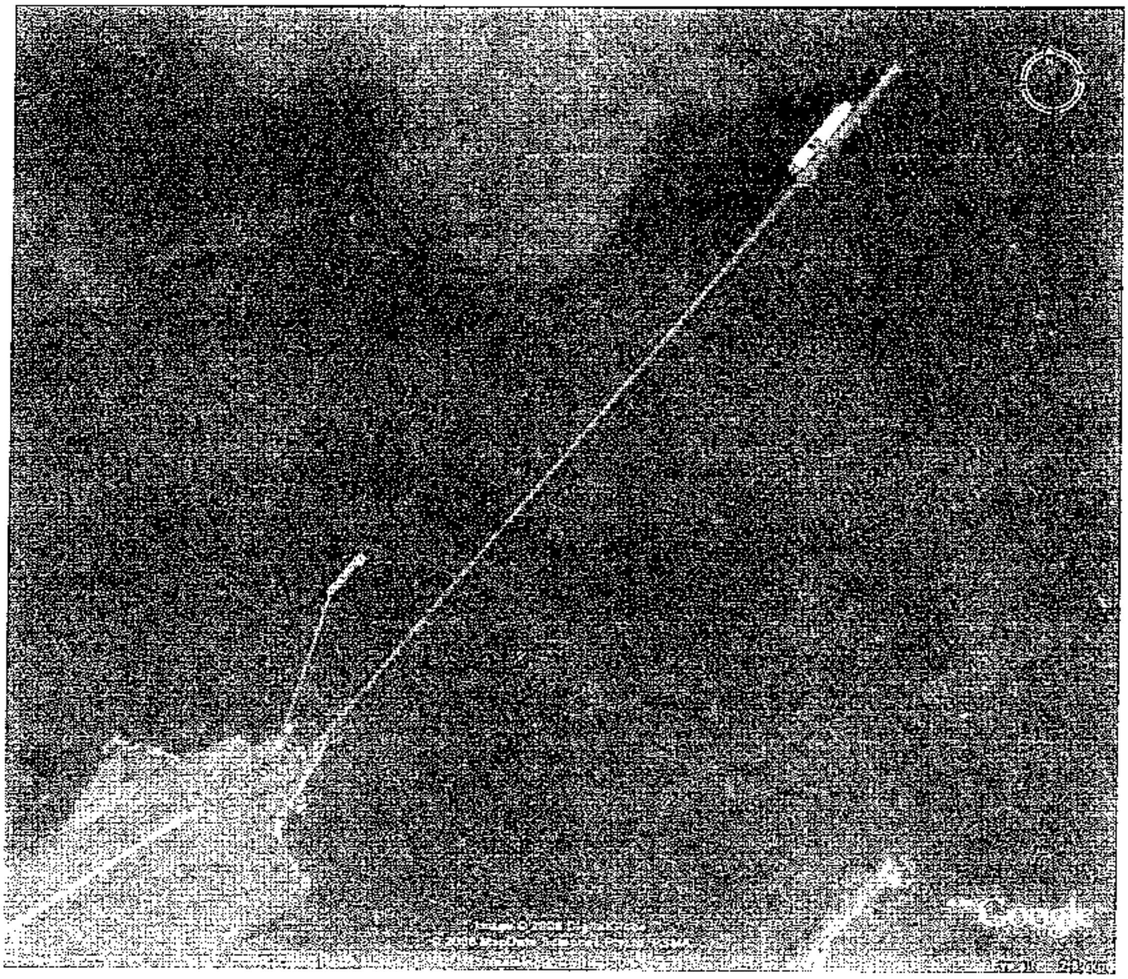
07 Point Samson Johns Creek

In 1984. /85 the dredging of the basin for the Johns Creek fishing boat harbour and the construction of a 40 tonne capacity slipway at Johns Creek, near point Samson were completed together with the provision of water and electrical services. A service Jetty and the first stage of boat pens were built and a groyne was constructed at the harbour entrance to give additional cyclone protection



Above Part of John's Creek small boat harbour, shortly after completion
Below - Aerial view of boat harbour 2007 ***google earth***

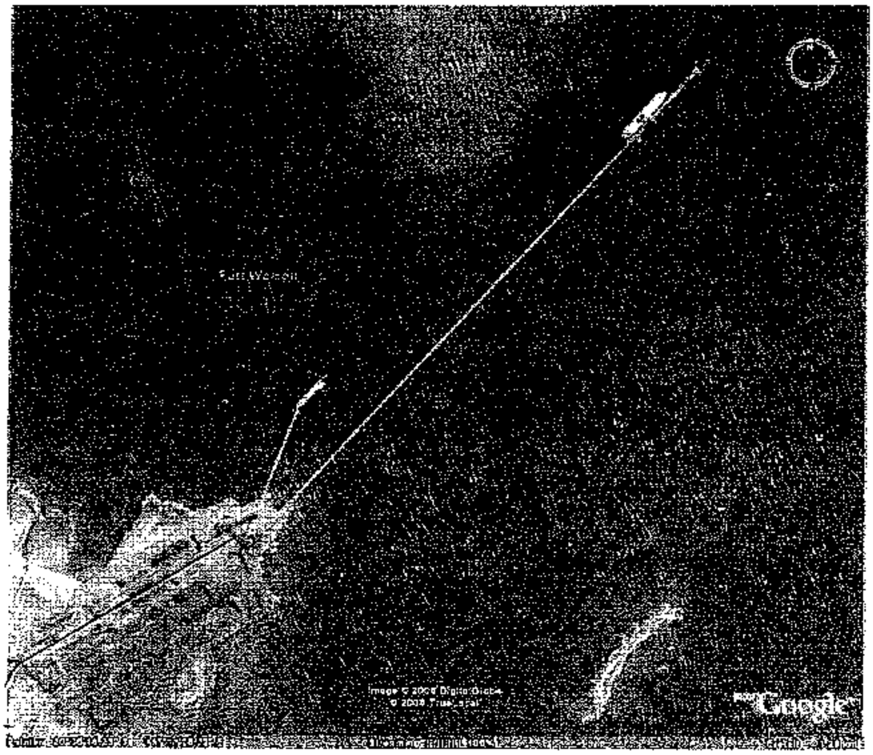




Cape Lambert - Robe River Iron export facility and service jetty 2007 *google earth*

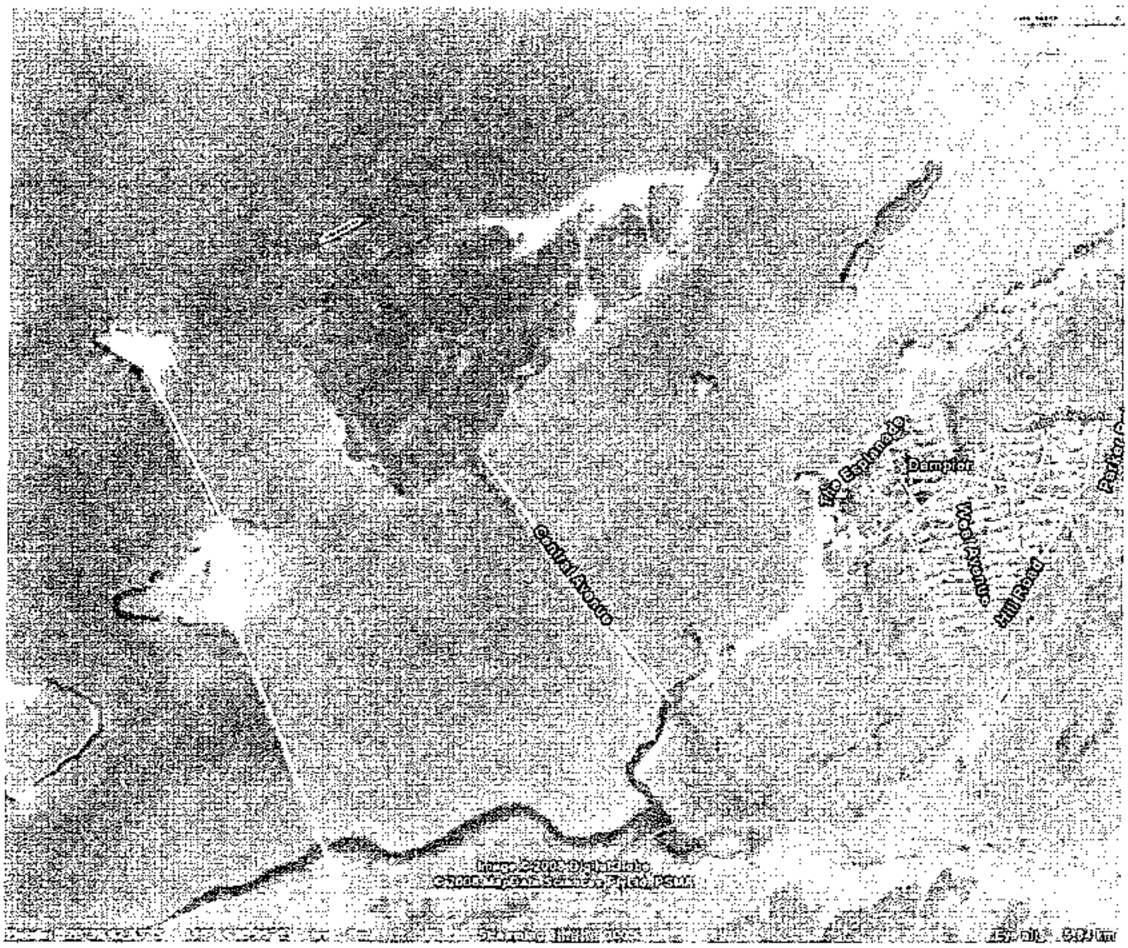
08 Cape Lambert

At Cape Lambert a Jetty for loading iron ore from Panawonica (Robe River) on to 150,000 tonnes deadweight carriers, was completed in 1972...



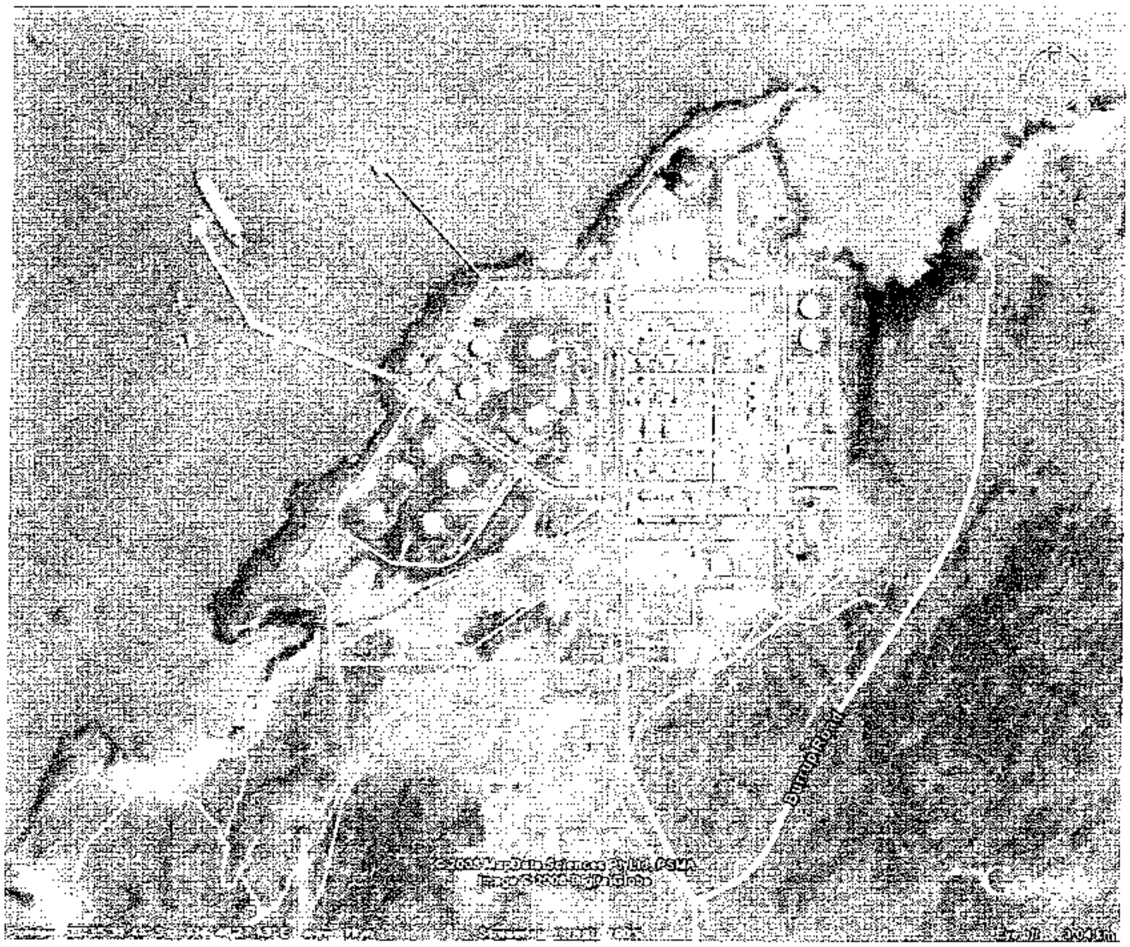
The 3.5 kilometre length jetty at Cape Lambert conveying ore to the three ore loading berths at the jetty head, being one of the highest and longest wharves in Australia. 2007 google earth

With the development of the iron ore export port at Cape Lambert, cargo handling was eventually transferred from the Point Samson jetty to the Company's service jetty. (shown to the west of the main ore loading pier in the photograph above)



Port of Dampier Hamersley Iron & Dampier Salt

2007 google earth

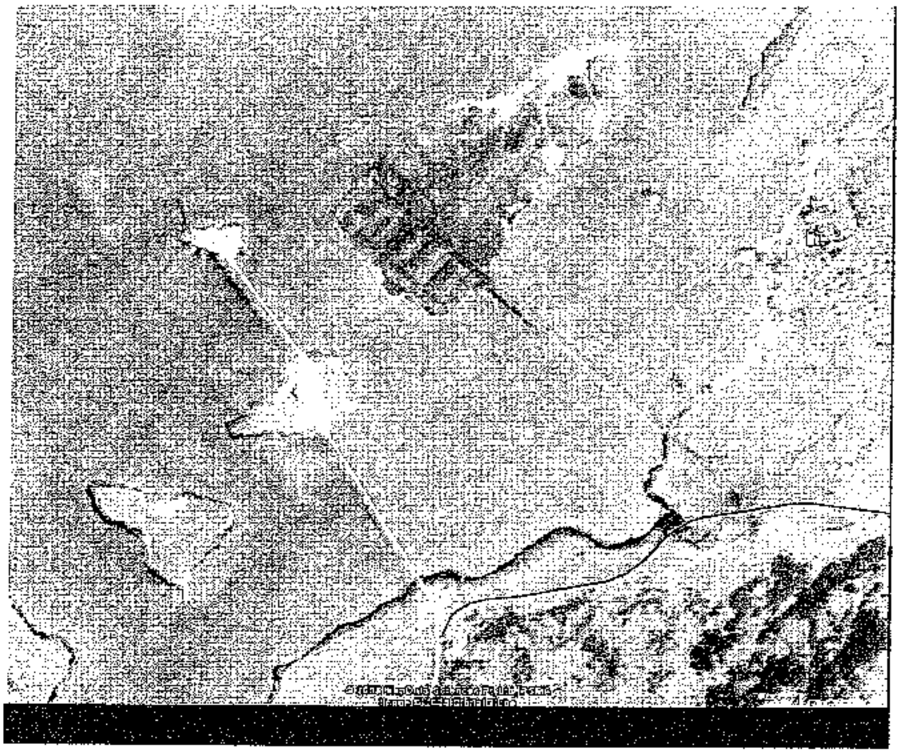


Burrup Peninsula LPG Export Facility 2007

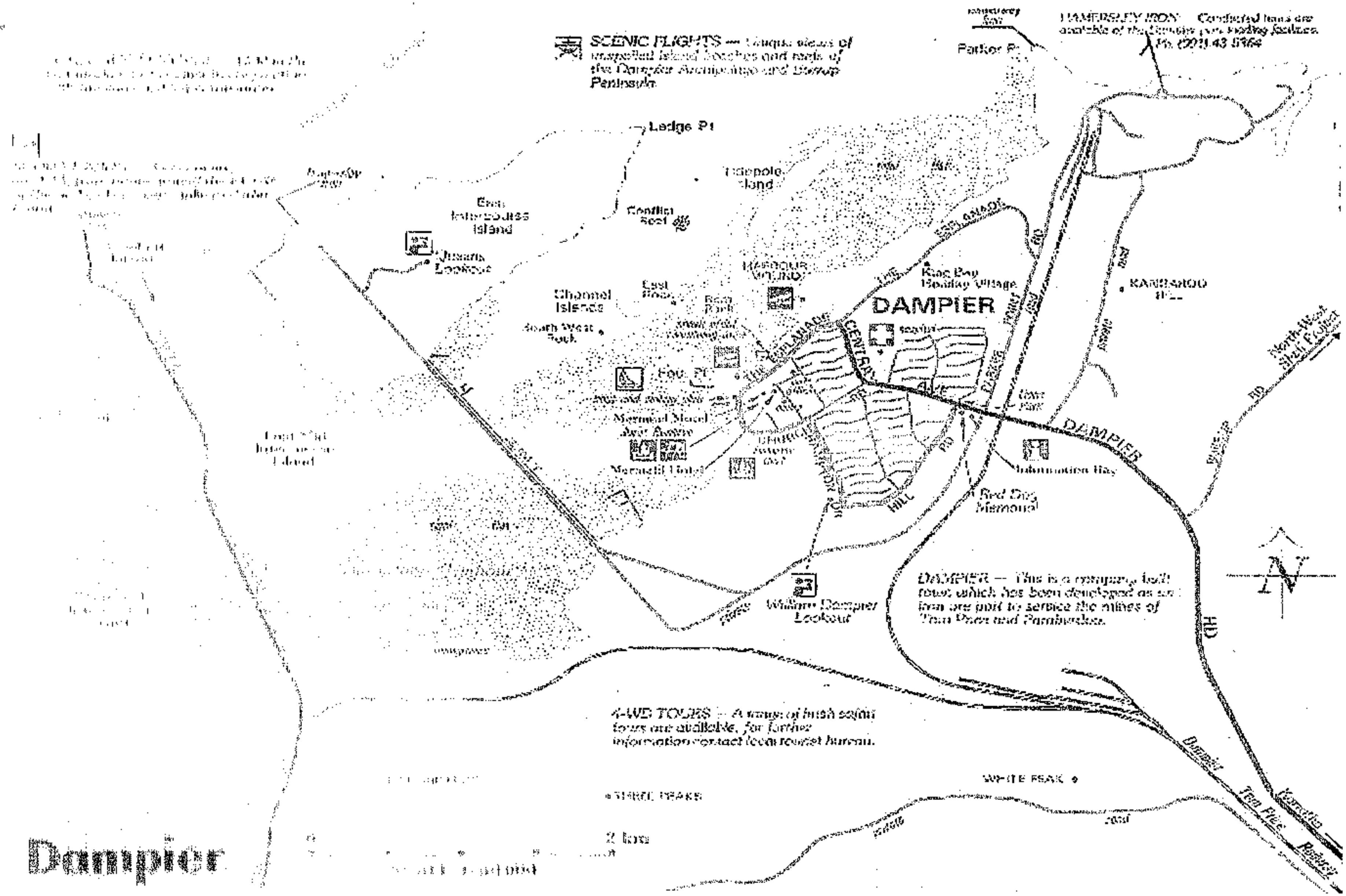
google earth

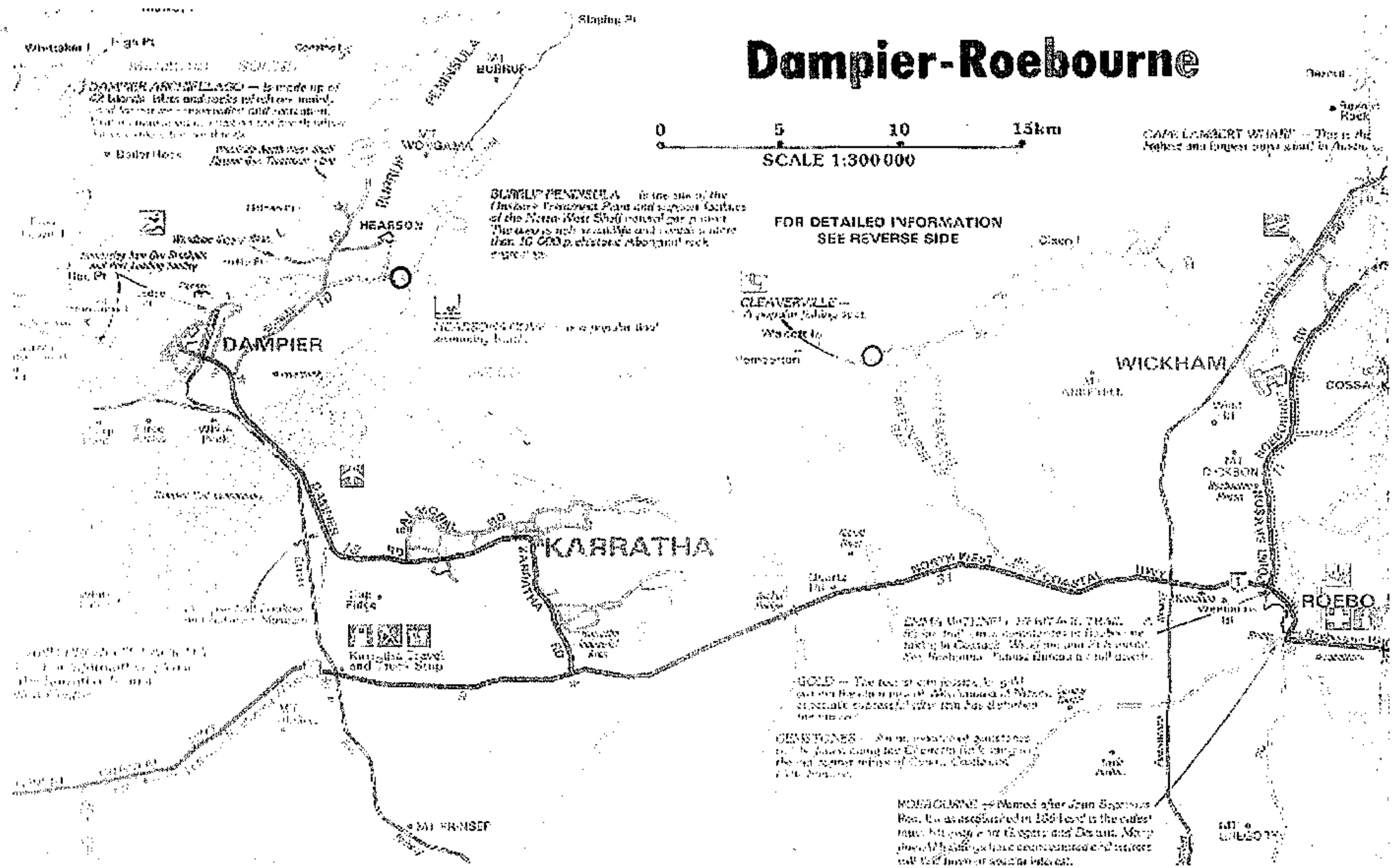
09 Dampier and Burrup Peninsula

After considerable development, Hamersley Iron Pty Ltd. began exporting bulk iron ore from Mount Tom Price over a newly built jetty in 1966, and began pelletising in 1968. Production and export or salt began in 1969 and the port became a base for oil exploration in 1971 – 72. . The State Electricity Commission of WA agreed to build a gas line southwards from Dampier in 1975, and export of LNG began in 1989

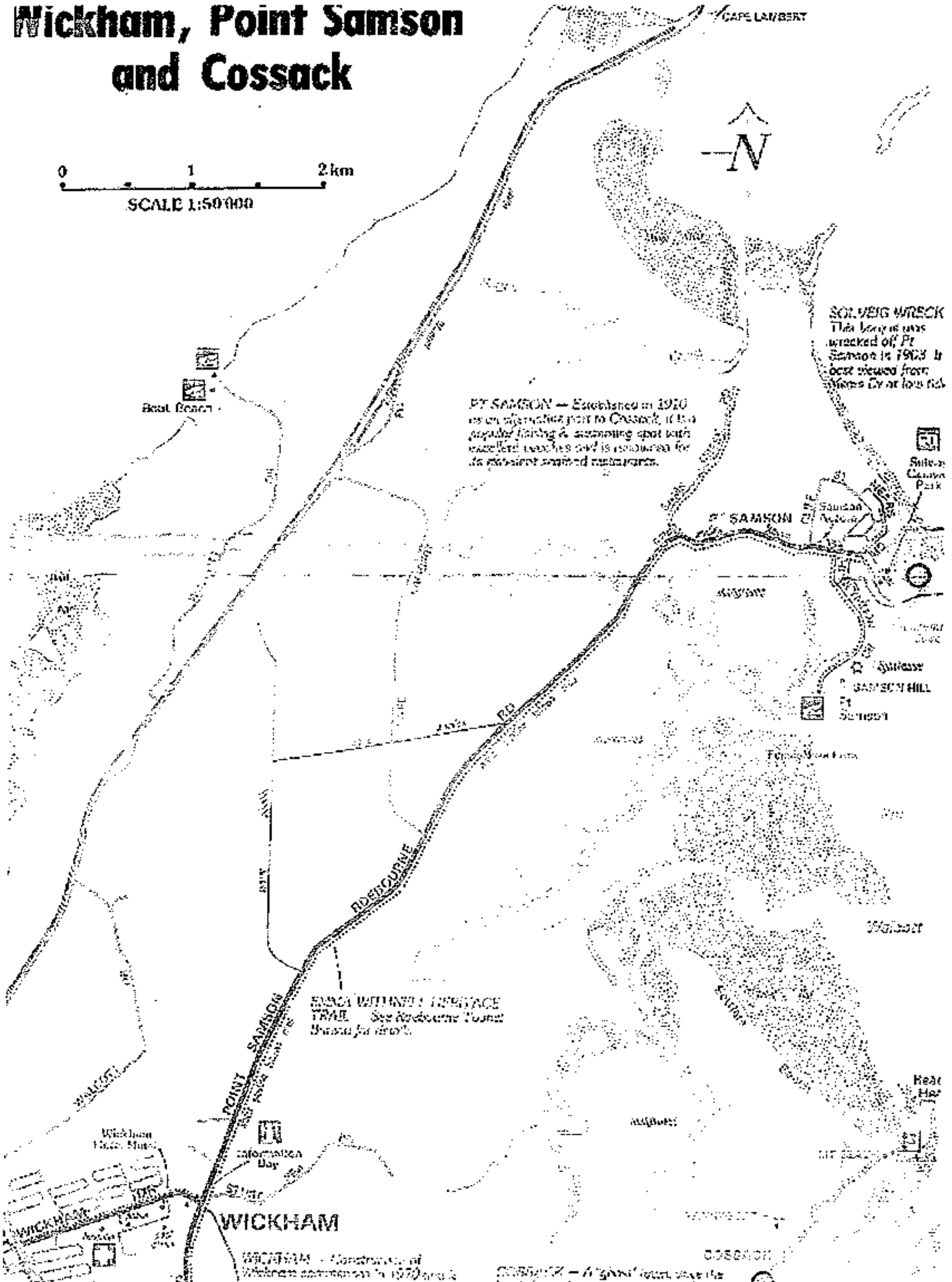


The Hamersley Iron export berth off Intercourse Island at Danpier, right and the Dampier Salt export berth, left.


SCENIC FLIGHTS — Unique views of unspoiled island beaches and reefs of the Dampier Archipelago and Burrup Peninsula
HAMERSLEY IRON — Conducted tours are available of the Dampier port loading facilities. Ph. (091) 43 5364
Parker Pt
Ledge Pt
Tadpole Island
Conflict Reef
East Intercourse Island
Jasons Lookout
Channel Islands
East Rock
Rosy Rock
South West Rock
Harbour Wharf
King Bay Holiday Village
DAMPIER
KANGAROO HILL
Four Pt
Mermaid Motel
Mermaid Hotel
Red Dog Memorial
Information Bay
William Dampier Lookout
North-West Shelf Project
DAMPIER
HD
THE ESPLANADE
CENTRAL AVE
HILL
RD
DAMPIER — This is a company built town which has been developed as an iron ore port to service the mines of Tom Price and Paraburdoo.
4-WD TOURS — A range of bush safari tours are available, for further information contact local tourist bureau.
WHITE PEAK
THREE PEAKS
2 km
Dampier
Tom Price
Railway
Karratha
Dampier


Dampier-Roebourne
0
5
10
15km
SCALE 1:300 000
FOR DETAILED INFORMATION
SEE REVERSE SIDE
DAMPIER
HEARSON
KARRATHA
WICKHAM
ROEBO
COSSA
CLEAVERVILLE
Slaping Pt
Whitaker I
MT WOYGAMA
MT BURRUP
BURRUP PENINSULA
MT DIXSON
Karratha Travel and Truck Stop
NORTH WEST COASTAL HWY
DAMPIER
KARRATHA
RD
GOLD
GEMSTONES
ROEBOURNE
CAPE LAMBERT WHARF
Dixon I
MT HERBERT
MT FRANSEF

Wickham, Point Samson and Cossack



10 Onslow

Early History

One of the first jetties built in the Onslow area was in 1893 when a jetty/ wharf was built near the mouth of the Ashburton River. A second jetty 2,760 feet long, built just outside the mouth of the Ashburton River in 1896 was destroyed by a cyclone soon after it was built.

In 1897 a jetty was built at Maud Landing, about 3 kilometres north of Coral Bay . It was 1,500 feet long with a 100 feet long by 20 feet head.

The original Onslow jetty was built in 1899 east of the Ashburton River and about 3 miles from the "old" Onslow town. In 1923 his jetty was described as being 1120 feet long with a two ton crane and light at the outer end and was connected to the then town of Onslow by a 3 mile light railway.

Following the silting up of the Ashburton River and its effect on the depth of water at the jetty, a new 2,162 feet long reinforced concrete jetty with a Tee head was built at Beadon Point in 1923 and the town of Onslow relocated to its present position in 1925.

In March 1953 the Beadon Point Jetty was badly damaged by a cyclone requiring the replacement of 240 piles throughout the structure with timber piles. Two more cyclones struck in March 1958 breaking 73 piles. and the first of three cyclones in January 1961 carried away 975 feet of the seaward end of the Jetty.

Harbour Development 1960s

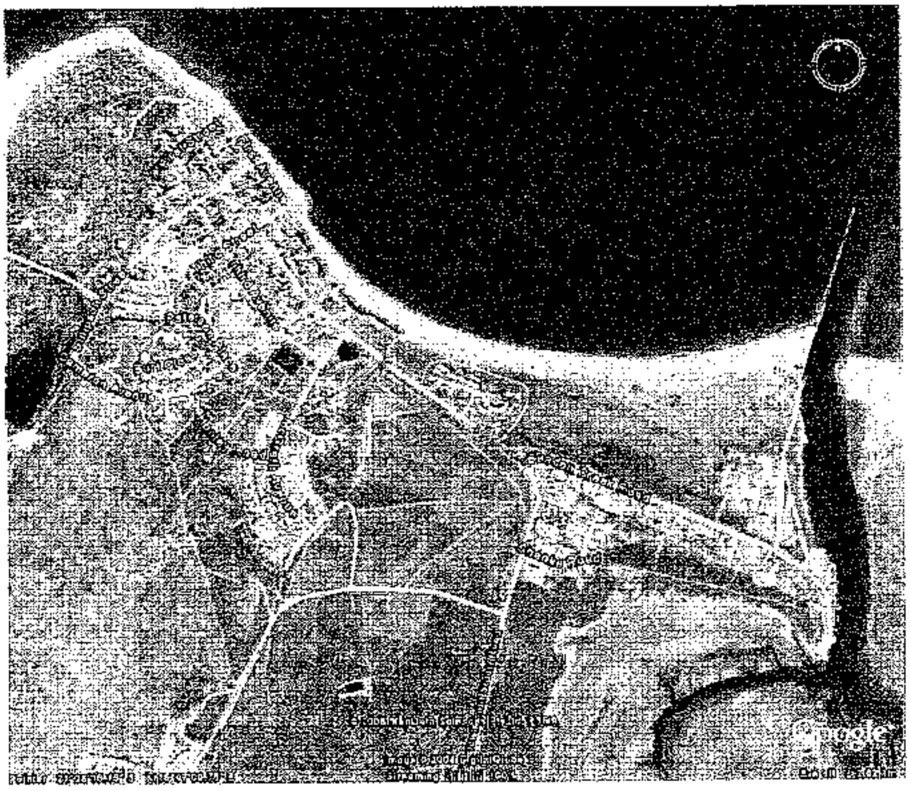
Following this damage it was decided not to rebuild the Jetty and a lighter berth was established at the shoreward end of the Jetty from which the 88 feet length Lighter" Ashburton" operated.

In 1966 the lighter berth was transferred from the Jetty to Beadon Creek, where a 2000 ft. length groyne was constructed on the south side of the ocean entrance to the Creek together with the dredging of a permanent channel to the lighter berth using the department's 8" cutter suction dredge PW 8. A goods yard was provided behind the new berth and a number of mooring piles were driven immediately upstream for small craft.

In 1972/73 the lighter berth in Beadon Greek at Onslow was partly rebuilt in steel with new mooring piles and horizontal fenders

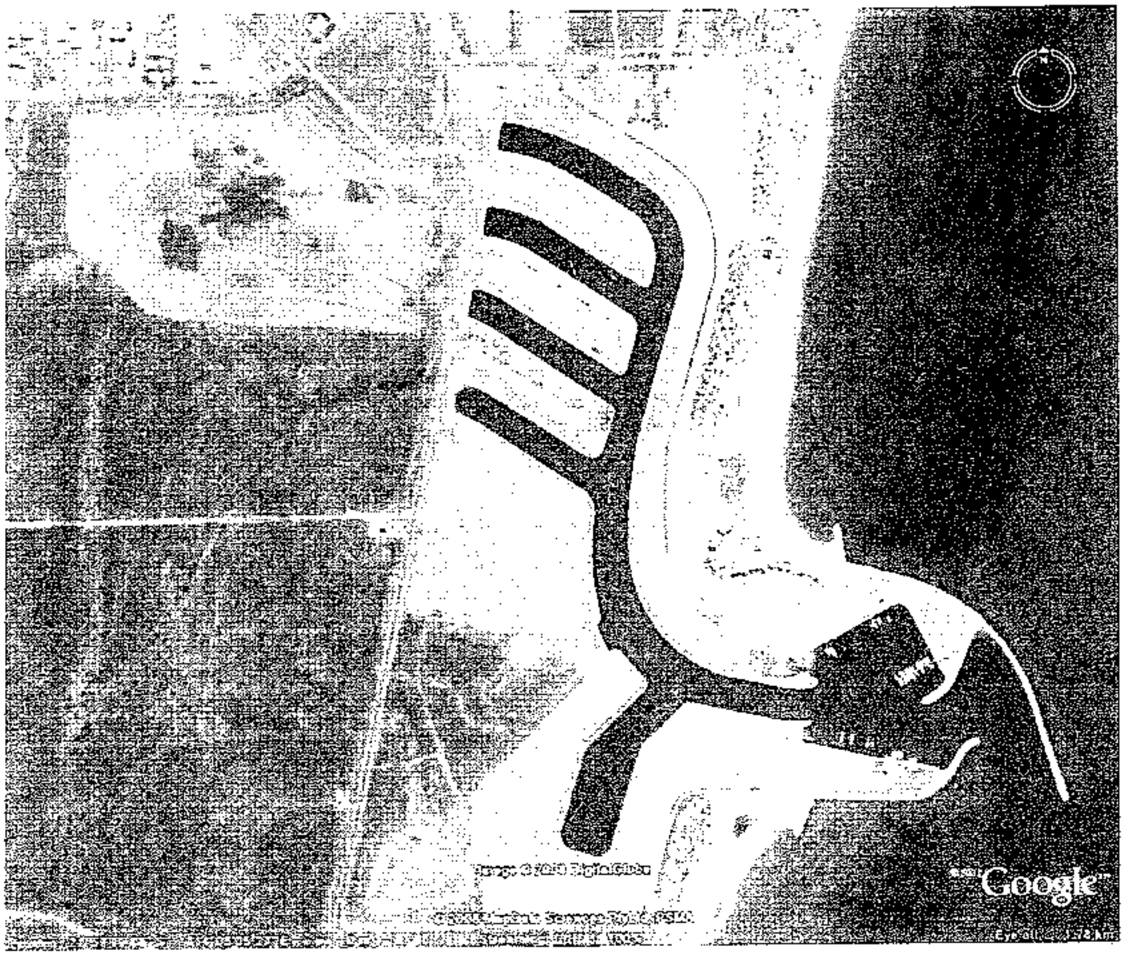
After the closing of Onslow as a commercial port in the late 1970s, the lighter berth in Beadon Creek was converted to a general purpose berth for the fishing and oil activities.

The Lighter "Ashburton" *The Lighter Berth, Beadon Creek*



Onslow - the original 1923 reinforced concrete jetty sprung from Beadon Point at the top left hand corner of the photograph. The Beadon Creek marine facility is on the right 2007 google earth

Gascoyne



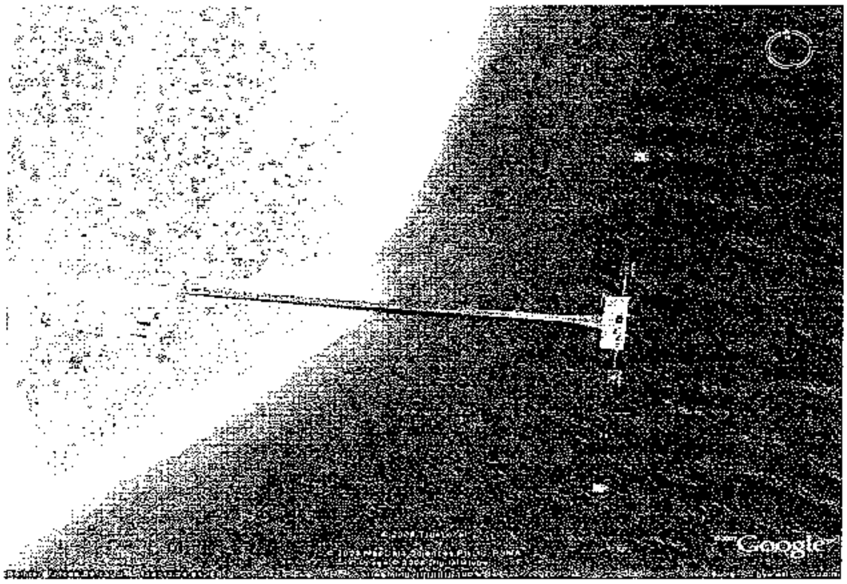
Exmouth Small Boat Harbour and Canal System

2007

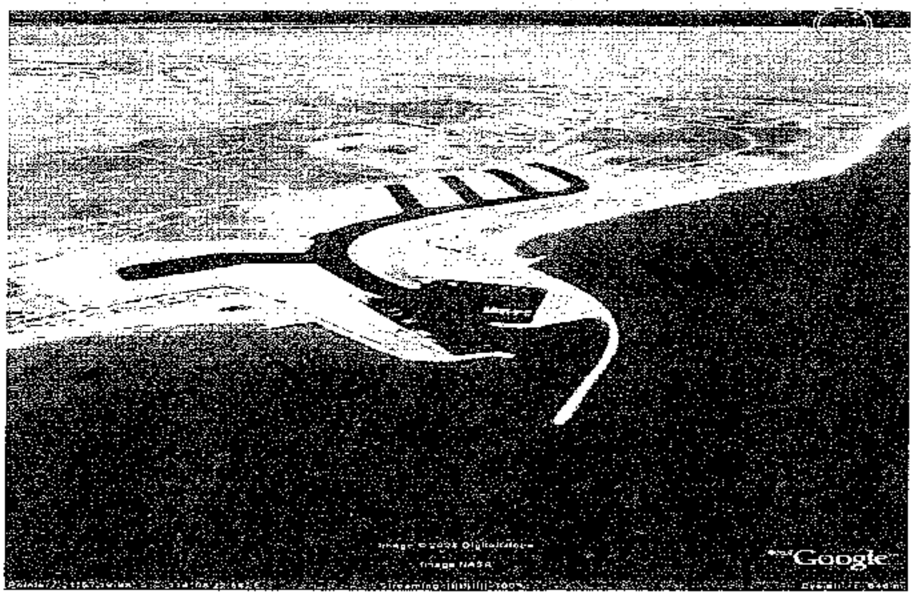
google earth

11 Exmouth

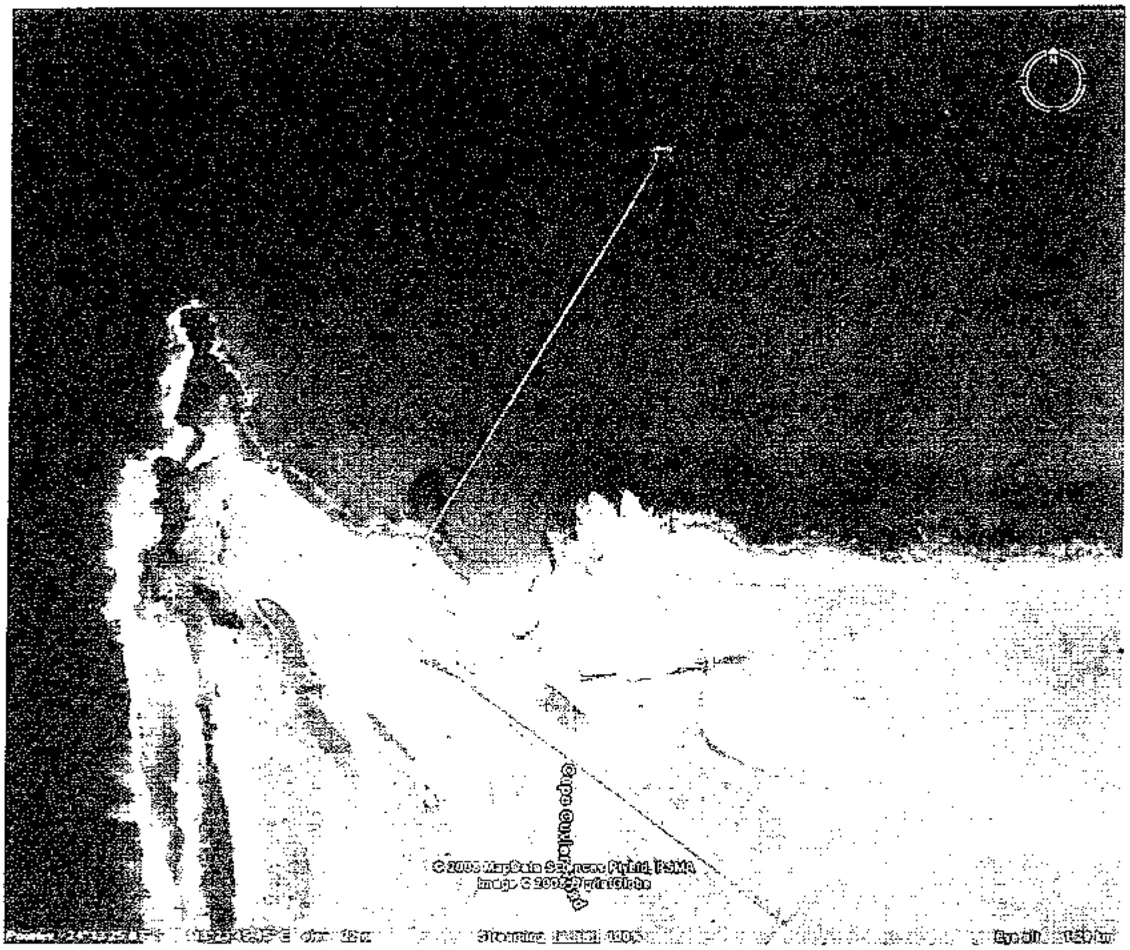
In 1985 provision of a launching ramp and pier facilities at Exmouth was examined and advice was given regarding a private marina proposal.



Exmouth Naval Jetty at Point Murat at northern end of Exmouth Gulf 2008 google earth



Exmouth Marina and Canal private development 2008 google earth

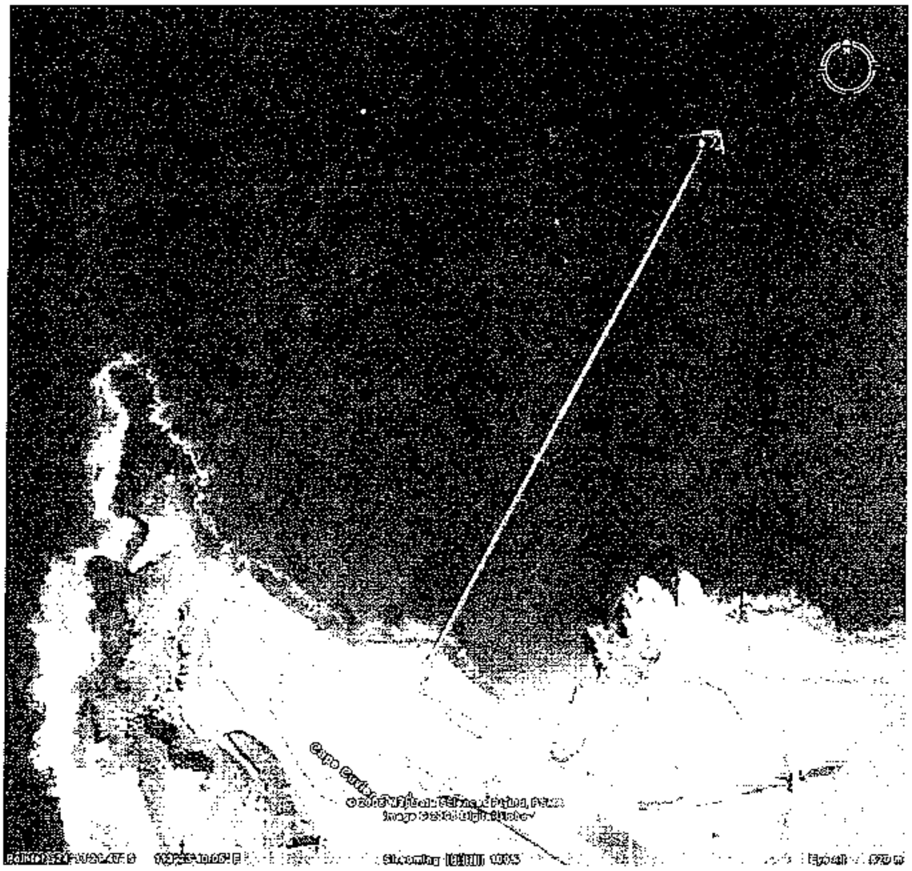


Cape Cuvier Salt Export Facility lake McLeod

google earth

12 Cape Cuvier

A private port was developed north of Carnarvon by Dampier Salt for the export of salt from Lake McLeod



13 Carnarvon

Early History

Carnarvon became the base for the pearling industry in the 1870s and following the proclamation of the Carnarvon townsite in 1886, the first jetty was built in the entrance to the southern arm of the Gascoyne River in 1887. In 1889 a second jetty for lighters was built at Mangrove Point, south west of the town.

In 1899 a 4,340 feet length jetty was built off Babbage Island with a 252 feet long by 30 feet wide head, The jetty was connected to the mainland by a 2 feet gauge light tramway which crossed over a 1,060 feet long bridge over the south arm of the Gascoyne River... The jetty was described in 1928 as being 4,900 feet long with berths 560 feet long into 11 feet of water at low tide

With the sealing of the Perth Carnarvon road in 1962, coastal shipping was abandoned in favour of road haulage,

In common with the other timber jetties in the north of the State the main work which was carried out to the Carnarvon Jetty between 1950 and 1970 was the continual replacement of timber piles and the ongoing maintenance of the rail sidings between the Jetty and the goods yard on shore. Maintenance costs at Carnarvon were particularly high due to the long Jetty length and the two rail bridges between the Jetty and the town. The Jetty was eventually closed to general cargo and used only as an oil receival facility. As incongruous as it may sound, one of the main imports over the Carnarvon Jetty in the mid 1960s were timber piles.

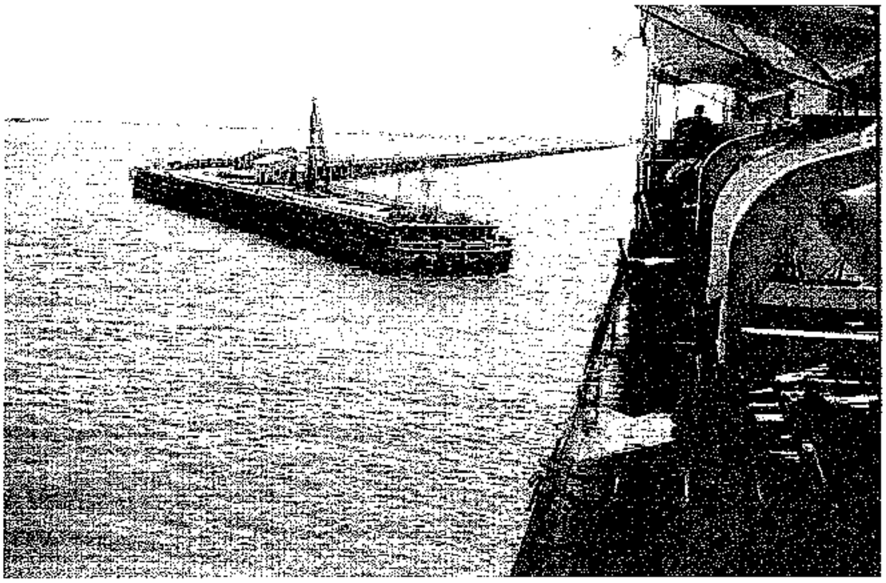
In 1970/71 the Carnarvon Jetty continued to be used by tankers for the import of petroleum products and it was being maintained for this purpose only.

In 1972/73 a contract was let to Toodyay Stone for the replacement of 960 feet of the old timber fascine wall on the south arm of the Gascoyne River with stone. Further repairs were carried out to the timber jetty for retaining the structure for tankers only.

Between 1974 and 1975 the renewal of 960 feet of the Carnarvon fascine wall in the south arm of the Gascoyne River was completed.

In March 1977 the timber Jetty was extensively damaged by cyclone "Hazel" and temporary walkways were built over parts of the Jetty to enable oil receivals to proceed.

In the late 1970s all commercial use of the jetty was phased out and it was handed over to the Carnarvon Shire as a tourist attraction.



The sea approach to the Carnarvon Jetty – note the heavy fendering at the end of the jetty around which many a vessel would pivot to lay nicely alongside the inner berth.

Carnarvon Jetty
Byron's Story

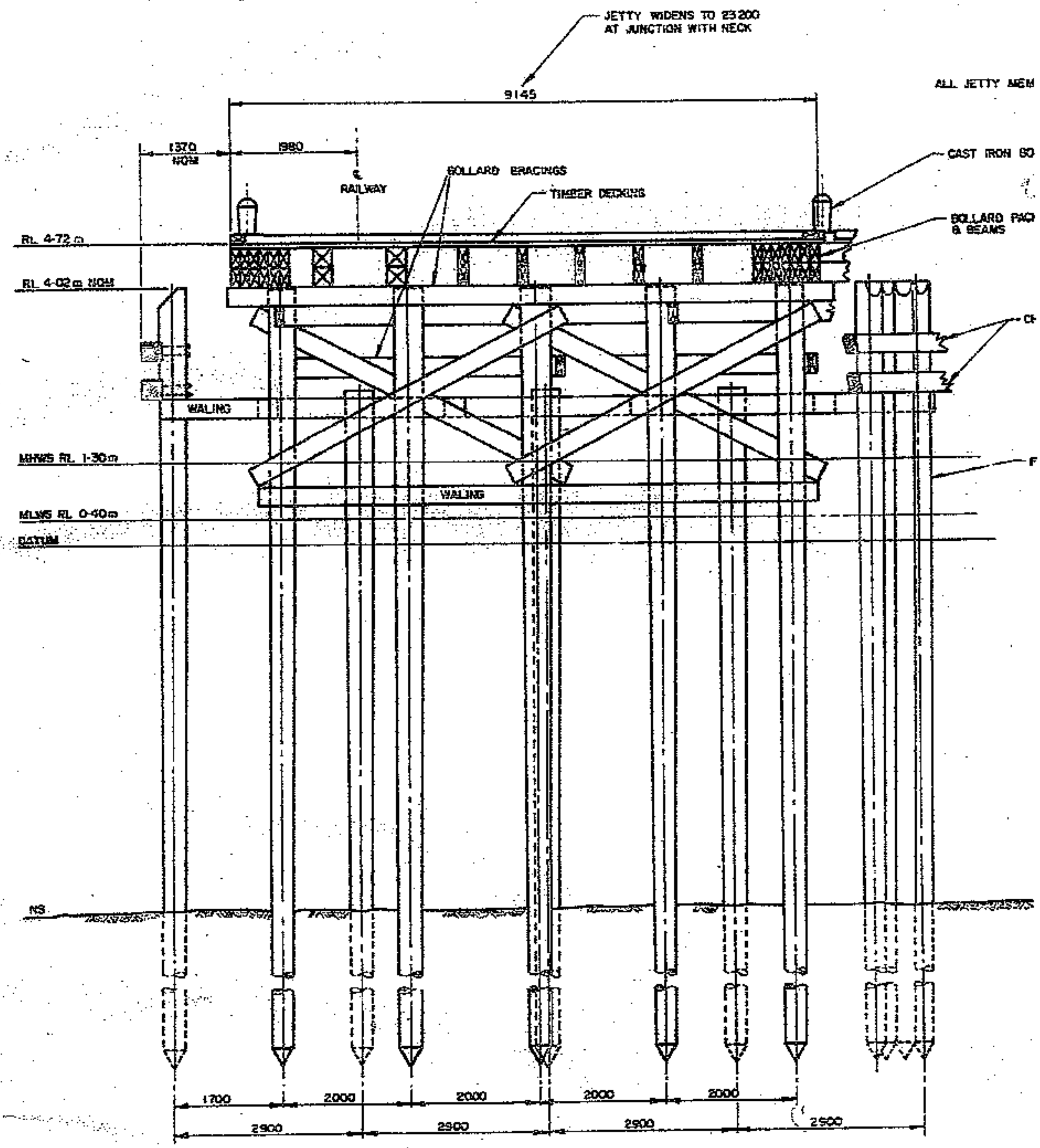
The District Engineer at Carnarvon, Byron Cornish could never understand why, that not long after he would have started to walk the near mile long jetty he would always be met by the jetty gang's "mechanised" rail transport to take him out to where the gang was working. How considerate of them, he thought sparing his legs that way.

It was not until several months later that he noticed an old dumpy level set up on its legs in one of the jetty sheds and directed through an open window towards the shore.

On looking through it he noted that it was permanently fixed on the foot of the jetty to pick up anyone about to step on the jetty. Then it dawned on him that this way he would never be able to sneak up on the gang and find them on an extended tea or lunch break!

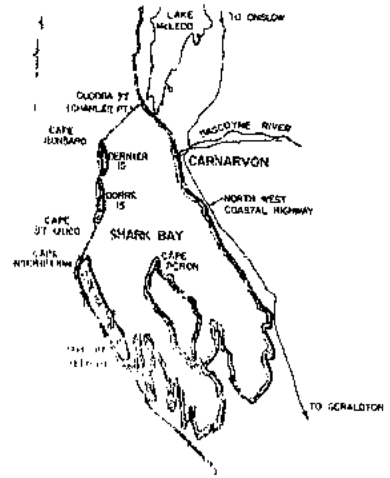
I think he then found a "shore job' for that dumpy level.

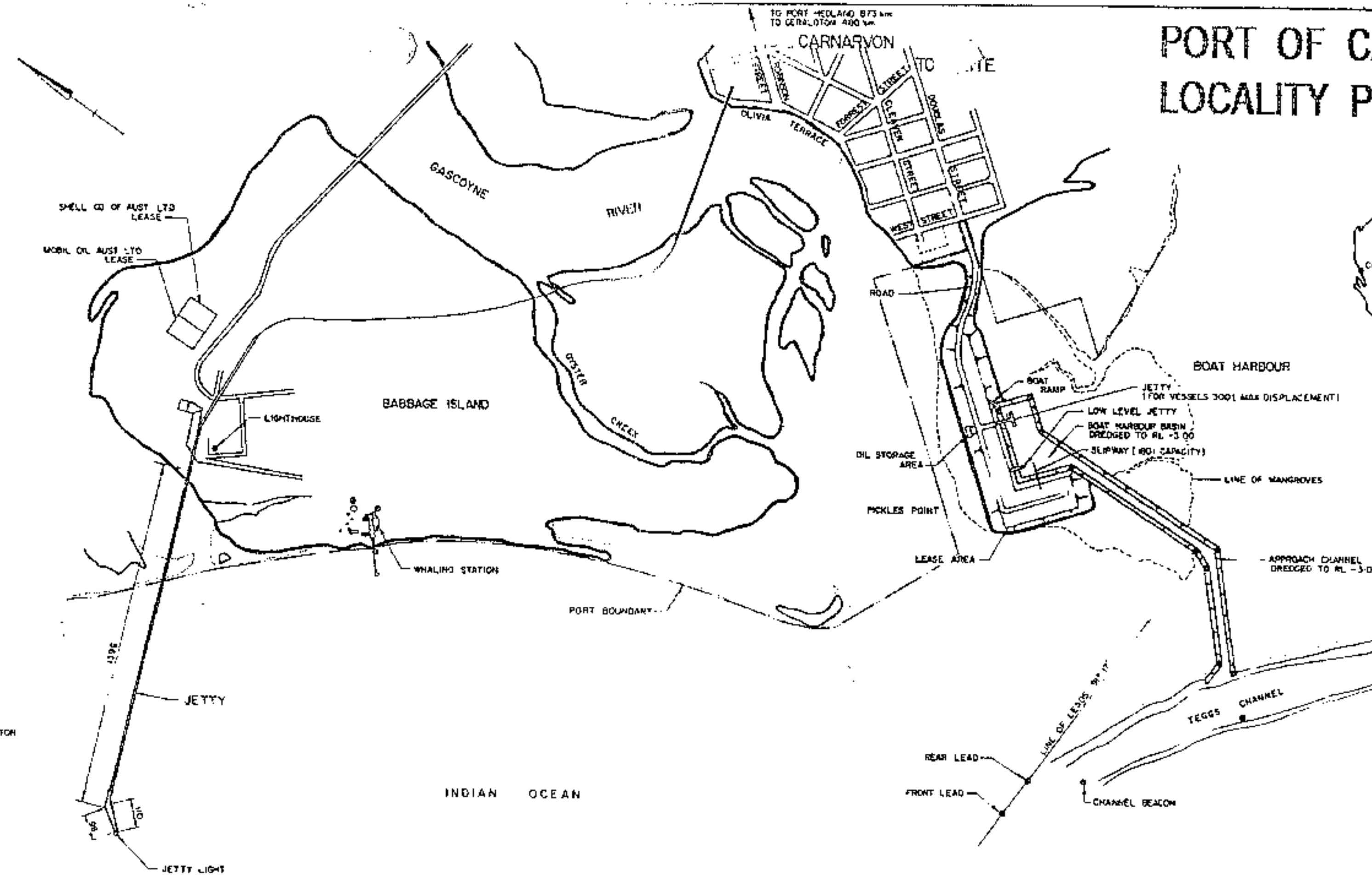
PORT OF CARNARVON
CROSS SECTION OF JETTY HEAD

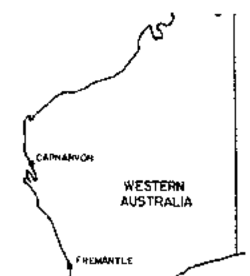


END ELEVATION OF HEAD ①
(PIERS AT 6 095 CENTRES)

PORT OF CARNARVON
LOCALITY PLAN







PLAN

REFERENCE PLANS

	PWD., WA
JETTY (OCEAN)	16153
SOUNDINGS (1980)	29576
BOAT HARBOUR	
LEASES & GENERAL ARRANGEMENT	47469
JETTY	48016
LOW LEVEL JETTY	52895
SLIPWAY (180t)	50252
DREDGING & RECLAMATION	47694
SOUNDINGS	50798
APPROACH CHANNEL SOUNDINGS	50780, 38514
THE FASCINE SOUNDINGS (1980)	52442
NAVIGATION AIDS	47459
PORT BOUNDARY	40490
HYDROGRAPHIC SURVEY (1982 ONWARDS)	54415
ADMIRALTY CHARTS	AUS 331, BA 1056

100 50 0 100 200 300 400 500 600 700

SCALE OF METRES (1:20000)

OIL SERVICE POINTS
PROVIDED AT BOTH BERTHS FOR THE DISCHARGE OF REFINED PETROLEUM PRODUCTS

ELECTRICAL SERVICES
JETTY LIGHTING IS FROM THE LOCAL 10kVA DIESEL DRIVEN ALTERNATOR SUPPLYING 234 VOLTS AC 50Hz.

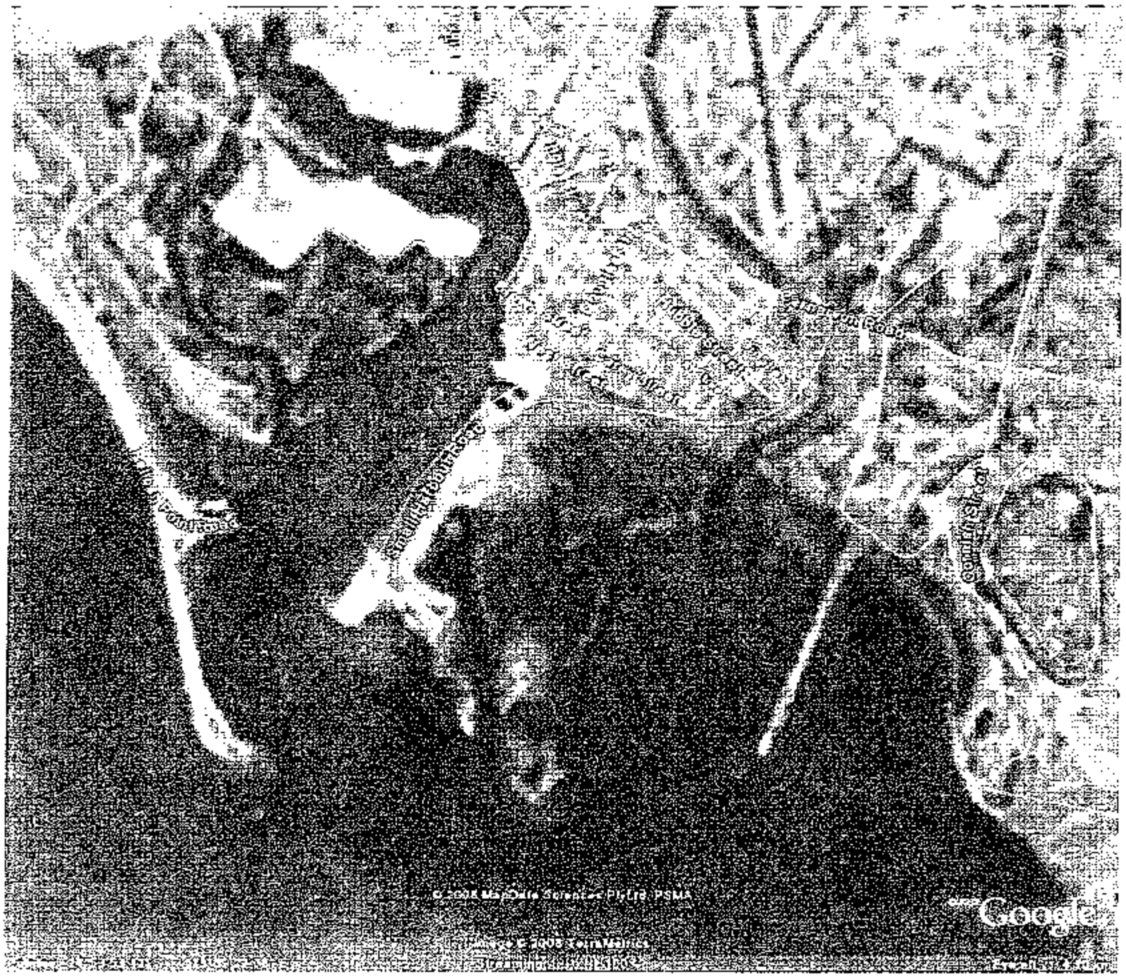
ROAD SERVICES
THE JETTY IS NOT ACCESSIBLE TO ROAD TRANSPORT

PORT OPERATING AUTHORITY
DEPARTMENT OF MARINE AND HARBOURS, FREMANTLE

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED. NO PREDICTIONS ARE AVAILABLE

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATIONS.

SCALES AS SHOWN	DESIGN CALC: BOOK	CHECKED: BOOK	PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
MICROFILMED	DRAWN: PJS	CHECKED: CS/JHS	REGIONAL PORTS OF WESTERN AUSTRALIA
DATUM	TRACED	CHECKED	PORT OF CARNARVON
AS SHOWN	SUPERVISING DESIGN ENGINEER, H&R		LOCALITY PLAN AND SERVICES DATA
	SUBMITTED: CHIEF DESIGN ENGINEER	DATE 20.12.83	APPROVED: CHIEF ENGINEER — DATE 24-1-84
			P.W.D., W.A. 53923 - 6 - 1



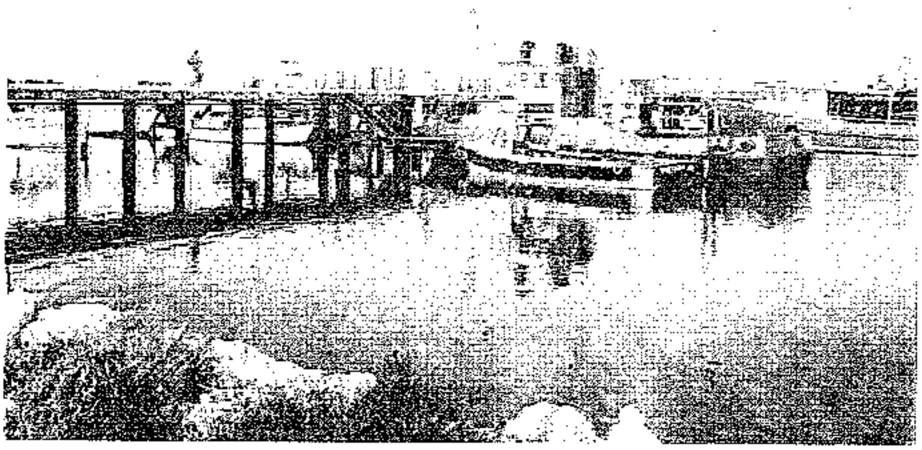
Carnarvon Fishing Boat Harbour 2007 google earth

14 Carnarvon Fishing Boat Harbour

Planning of a fishing boat harbour for Carnarvon commenced in the early 1970s. A contract was let to Dredging Industries (Aust.) Pty Ltd for the removal of spoil from Teggs Channel and the new fishing boat harbour basin at Pickles Point.
Dredging and associated reclamation commenced in May 1973 and was completed in February 1975, by which time 556,000 cubic metres of material had been removed.
Construction of a steel piled, concrete decked service jetty followed which was first used for the landing of a catch on February 19th 1976. A lay by jetty was built for vessels of the Fisheries and Wildlife and Harbour and Light Departments.
The harbour was officially opened by Minister for Works O'Neil on July 28th 1976. A new slipway with provision for multiple cradles and transverse parking was opened on November 3rd 1978. The slipway had an ultimate design capacity of 180 tonnes. Maintenance dredging in Teggs Channel was required following siltation caused by the major floods on the Gascoyne River in June 1980.

The resident engineer for the project was Ian Hutton.

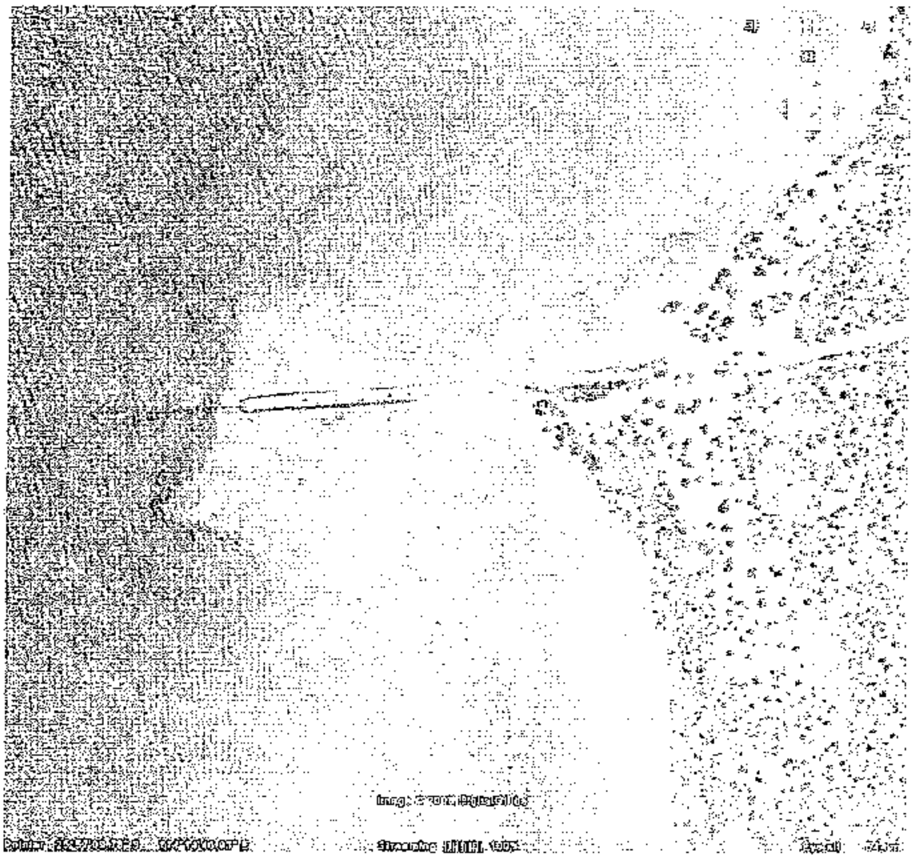
Between 1980 and 1983 maintenance dredging of Teggs Channel and the approach channel to the fishing boat harbour and the basin was carried out. A low level fish landing was constructed off the service Jetty and some minor improvements were carried out to the slipway together with the provision of a launching ramp.



The main service jetty at the Carnarvon Fishing Boat Harbour

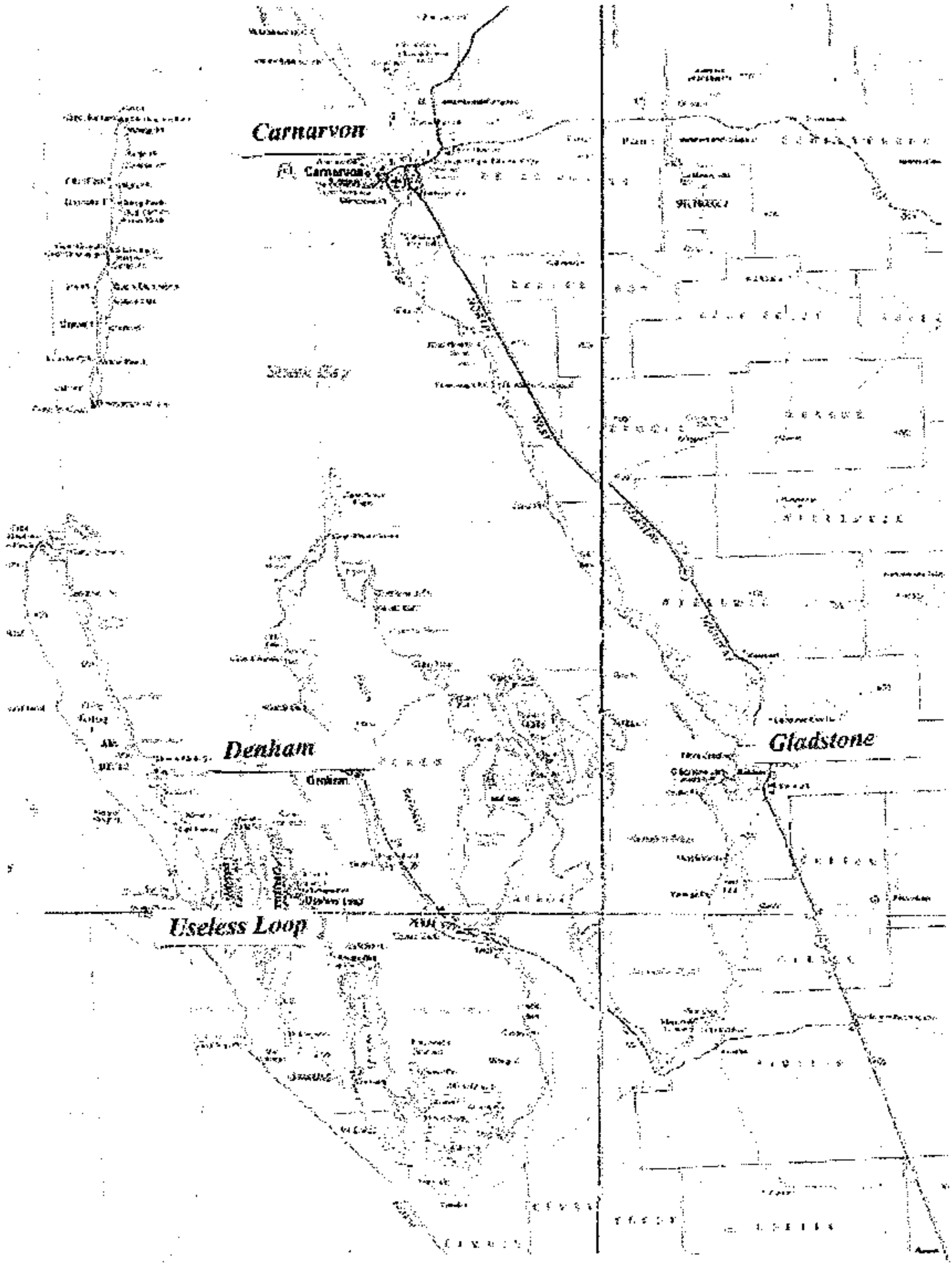
15 Gladstone

A small port was established at Gladstone, on the eastern side of Shark Bay in 1910 to the west of Yarringa Station. It consisted of a well constructed 287 metre long rock causeway, carrying a light tramway which led from a wool store shed to a small timber jetty with a 63 metre long neck terminating at a 14 metre length by 6 metre width head with two metres of water at low tide at the berth

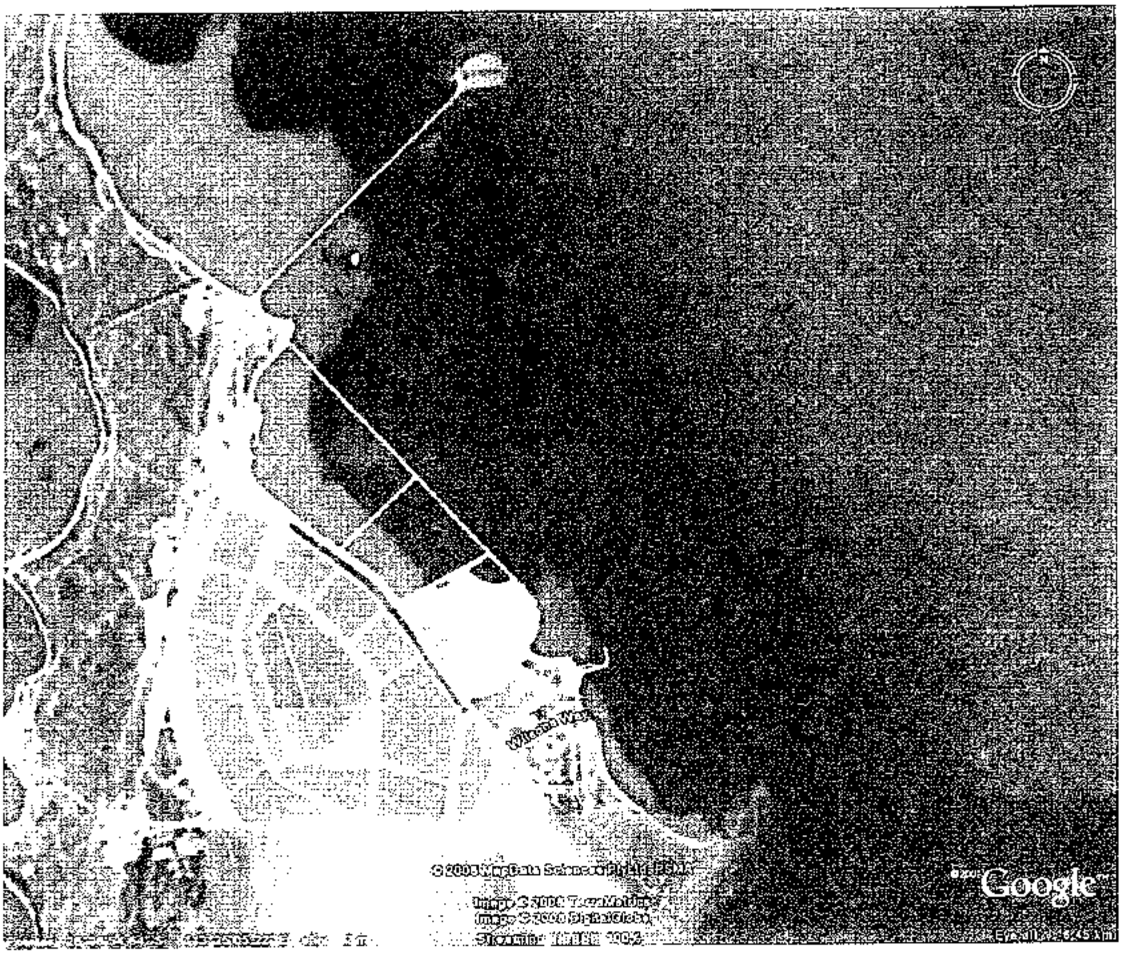


The remains of the rock causeway and jetty at Gladstone

google earth 2008



Jetties in the Carnarvon Shark Bay Area



Shark Bay Salt Export Facility Useless Loop

2007 google earth

16 Denham

Early History

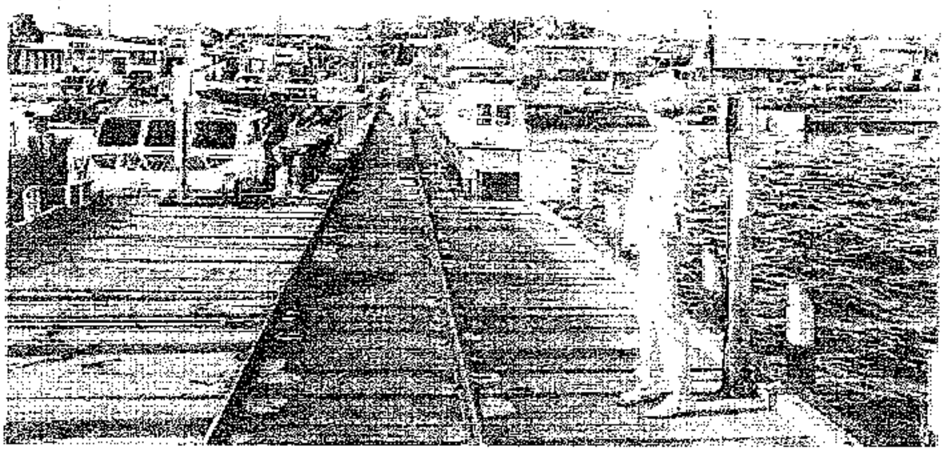
In the early 1900s several small jetties were built at the foot the town to serve small craft, In 1957 a narrow jetty with light rail and a slipway was built off from Brockman Street in the centre of the town.

Development 1970s

In 1977 repairs to a damaged section of Jetty caused by cyclone "Hazel" were carried out and the Jetty reduced in length. A 600 metre length channel was dredged to the new jetty head

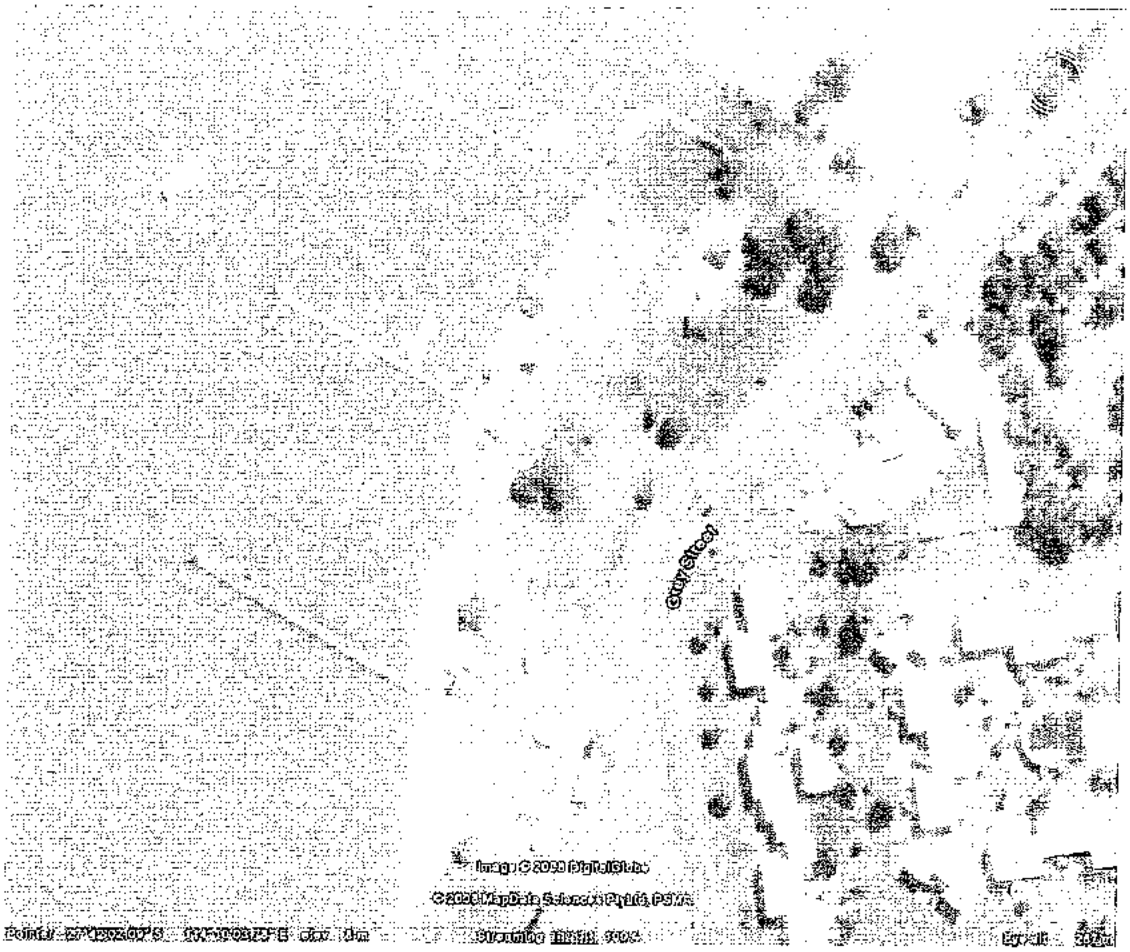
Between 1981 and 1982 dredging proceeded on the inshore basin and the approach channel and the construction of a slipway/ launching ramp and new jetty was completed.

In 1984 reclaimed land behind the harbour was sealed and water and electricity services were connected to the slipway and the new jetty.



Denham Jetty

Mid West



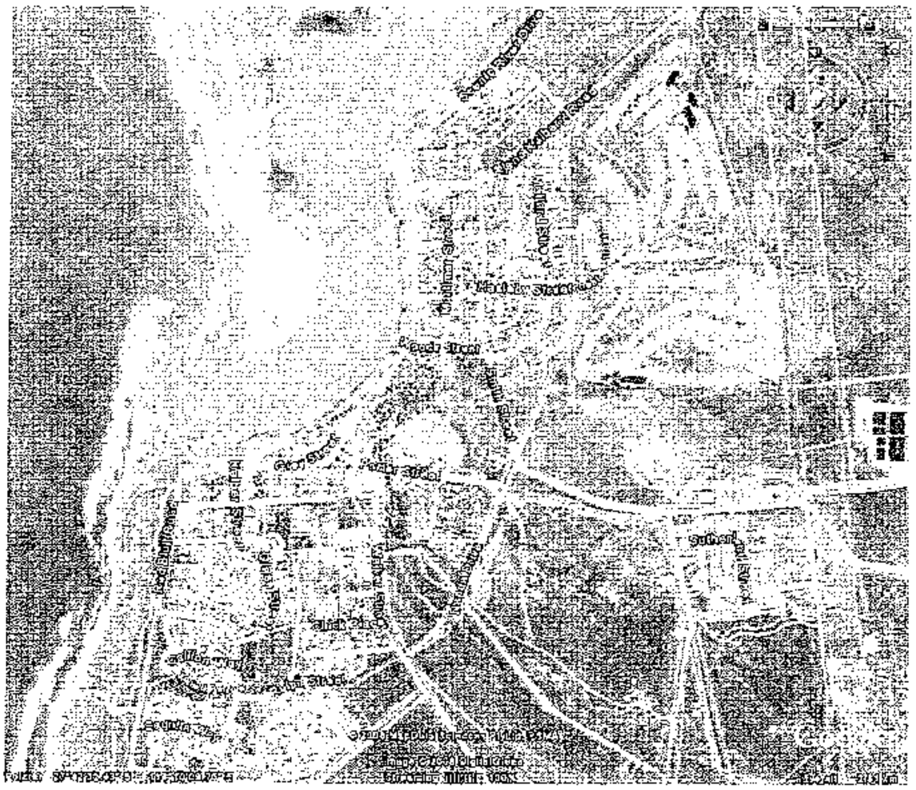
Kalbarri Small Craft Facilities 2007 google earth

17 Kalbarri

Kalbarri is a small fishing and tourist centre located some 600 kilometres north of Perth, at the mouth of the Murchison River. The Murchison River ocean entrance provides access to the Indian Ocean for vessels using the services and shelter of the Kalbarri Maritime Facility. After extensive additions to the original facility were completed, the $1.22 million Kalbarri Maritime Facility was opened officially on 8 May 1999, by the then Minister for Transport, the Hon. Murray Criddle, MLC.

The maritime facilities were located approximately two kilometres upstream from the river mouth, where there were 32 commercial boat pens. (4 x 12 metres, 4 x 15 metres , 22 x 18 metres and 2 x greater than 20 metres) with a 100% occupancy .Pens were supplied with lighting, single and three phase power and water

There was one service jetty at the facility, constructed of steel piles with timber decking.



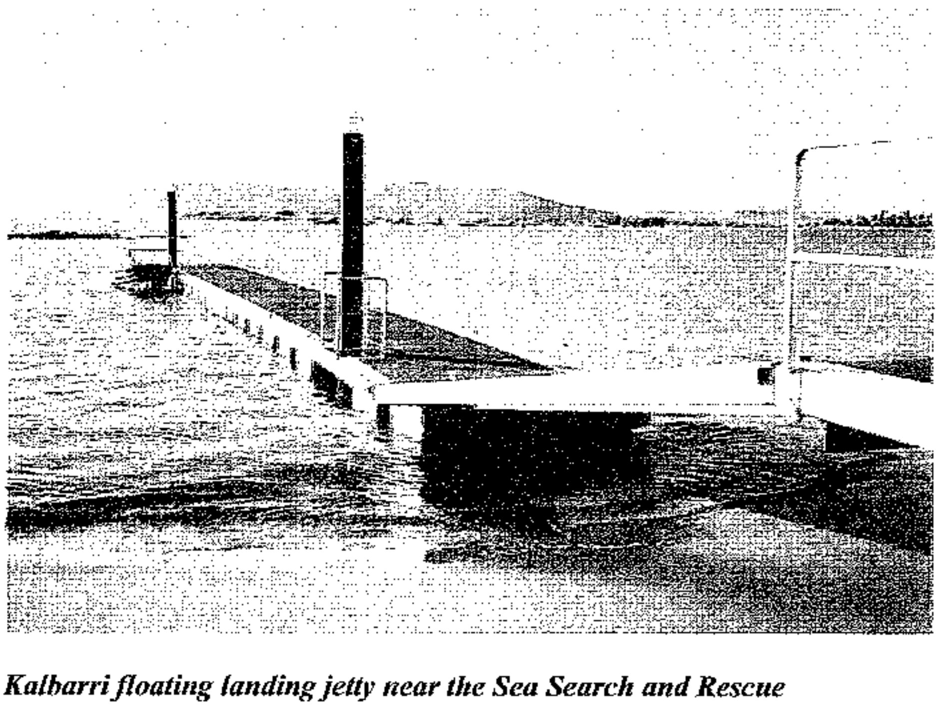
Kalbarri showing the ocean outlet of the Murchison River - 2008 \google earth

In 1998, the service jetty was extended at the head by a length of 20.5 metres and an overall width of 7.15 metres (including chafers). The original jetty was 58.5 metres long and 3.8 metres wide (including chafers and was supplied with Lighting, single and three phase power, water and fuel.

Kalbarri Service Jetty and Boat Pens

There were two boat launching ramps in Kalbarri, one of the ramps being located to the east of the commercial boat pens. The main boat launching facility was located next to the Kalbarri Sea Search and Rescue building near the river mouth and is now owned and operated by the Shire.

A second jetty, located next to the river mouth boat launching ramp, was constructed in 1998 with joint funding from the Department for Planning and Infrastructure and the Shire of Northampton. The Shire owns and operates the jetty.

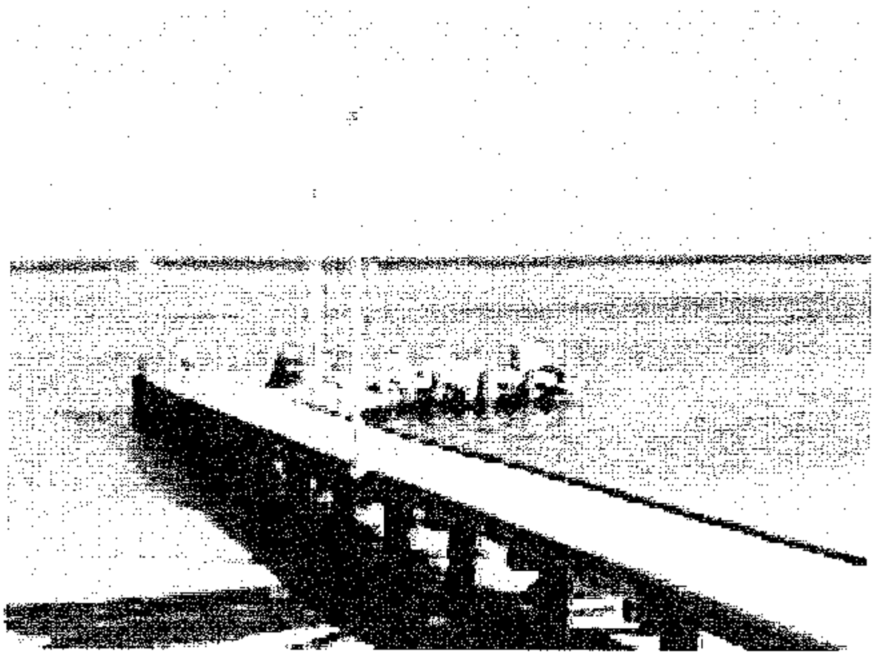


Kalbarri floating landing jetty near the Sea Search and Rescue building,

18 Port Gregory

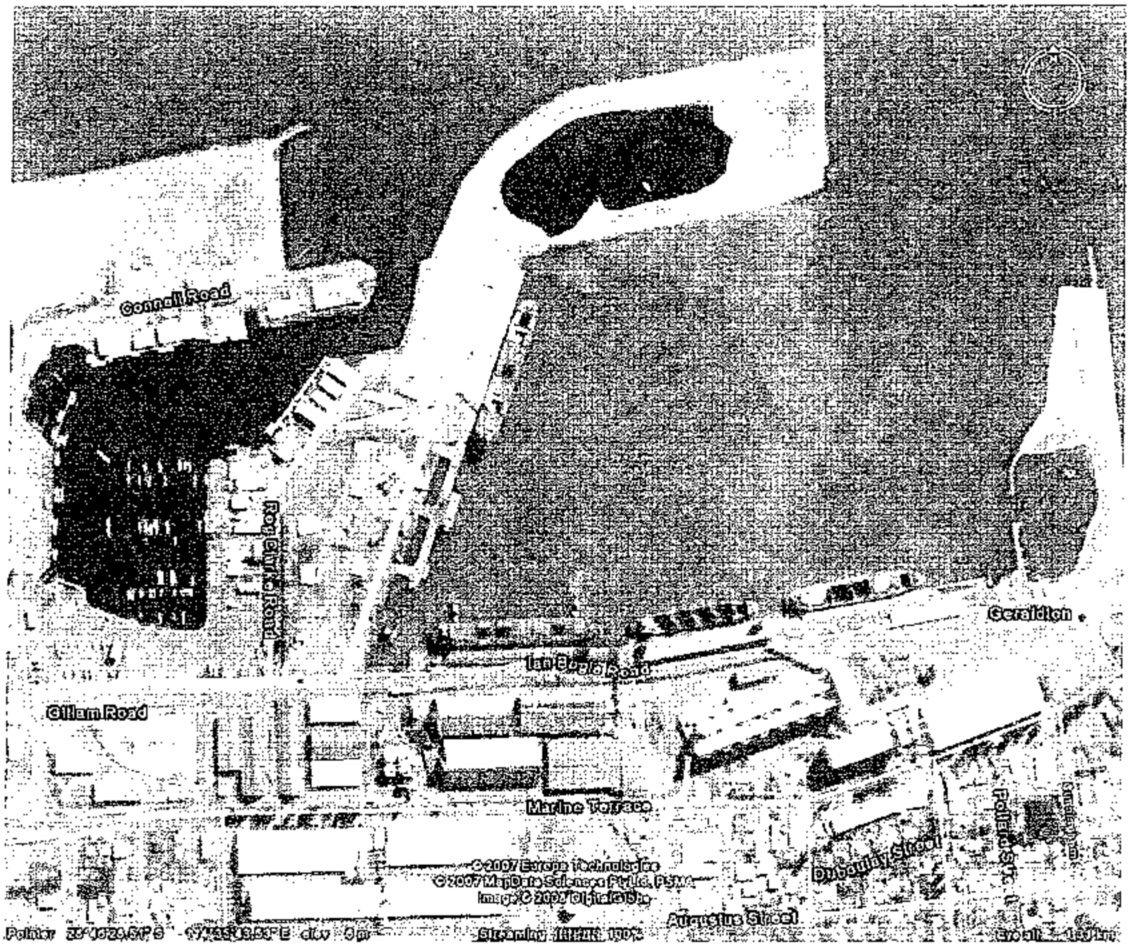
Early History

Port Gregory was developed as a port in 1850 for the Geraldine Lead Mine which was established in 1849. A convict hiring depot was established in nearby Lynton in 1852 to supply labour to the mine and the pastoralists. Waling commenced in 1853 and the townsites of Pakington at Port Gregory and Lynton on the Hutt River were gazetted in 1855.
In the 1860s a small jetty was built at the port which was later abandoned. Another jetty was built in 1914 to which a tee head was added in 919 and from which salt harvested from the Hutt River lagoon was loaded for Geraldton. The salt works closed down in the late 1920s, with the port eventually being abandoned in the 1930s.



Port Gregory Jetty 2008 ***acknowledgement DP&I WA***

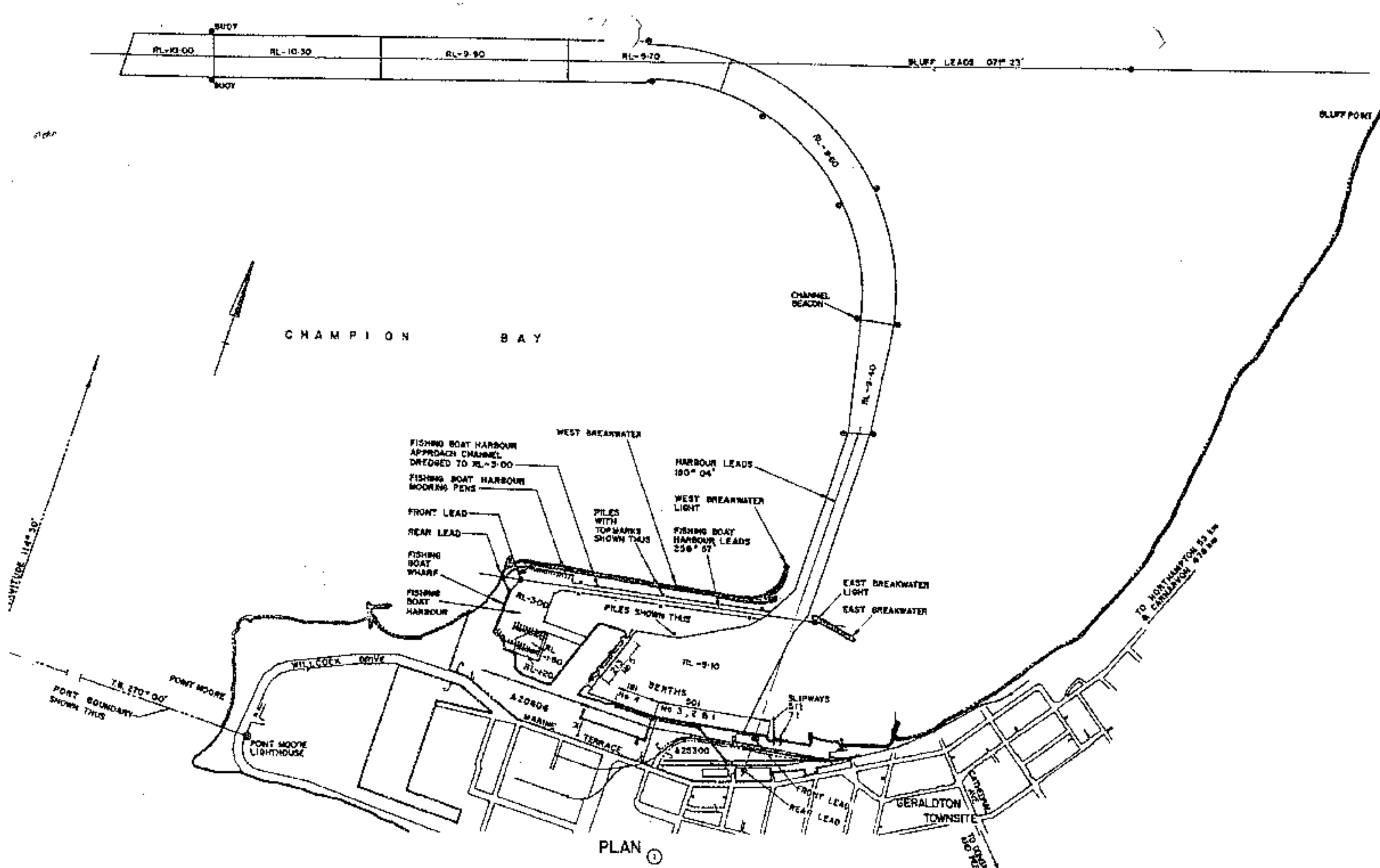
Today Port Gregory, which is located 47 kilometres northwest of Northampton, has a population of approximately 80 people. It supports a small commercial fishing fleet and also has a small tourist industry. Fishing and diving are popular activities.
Port Gregory is protected by 5 kilometres of exposed coral reef, which provides relatively safe anchorage for both recreational and commercial vessels. The reef is long and almost continuous, and about 1 metre high.
The Port Gregory Maritime Facility consists of one wooden service jetty, situated in open waters but protected by the reef. The facility was constructed in 1980.



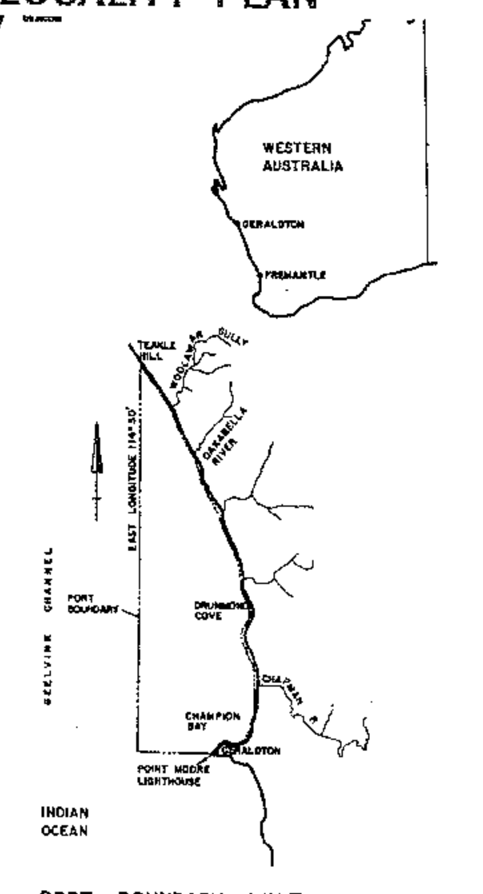
Port of Geraldton 2007

google earth

PORT OF GERALDTON
LOCALITY PLAN



PLAN (1)



PORT BOUNDARY LIMIT (2)

PORT INFORMATION

POSITION

LAT 28° 47' S, LONG 114° 36' E.

DATUM

CHART DATUM WHICH IS ZERO ON THE TIDE GAUGE AND 0·847 m BELOW AHD.

ACCOMMODATION

WELL DEFINED APPROACHES THROUGH REEFS TO ENTRANCE CHANNEL WHICH LEADS INTO A BREAKWATER ENCLOSED HARBOUR, SAFE IN ALL WEATHER CONDITIONS. WHARF COMPRISES THREE ADJACENT LAND BACKED BERTHS OF TOTAL LENGTH 501 m, No 4 LAND BACKED BERTH OF 181 m, AND No 5 BERTH OF 213 m. MINIMUM DEPTH ALONGSIDE No 1 LAND BACKED BERTH IS 8·4 m, MINIMUM DEPTH ALONGSIDE No 2, 3, 4 & 5 BERTHS IS 9·4 m. THE TIDE RISE IS 1·2 m. A FISHING BOAT WHARF IS LOCATED AT THE WESTERN END OF THE HARBOUR. GOODS SHEDS AND BONDED STORES ARE SITUATED AT THE BACK OF No 1 BERTH. CUSTOMS OFFICERS ARE ON DUTY.

IMPORTS

PHOSPHATE ROCK AND AGRICULTURAL FERTILISERS, REFINED PETROLEUM PRODUCTS.

EXPORTS

WHEAT, FLOUR, SHEEP, WOOL, LOBSTER TAILS, GENERAL CARGO AND MINERALS.

CARGO HANDLING

BY SHIP'S GEAR ON AND OFF RAILWAY WAGONS AND ROAD TRANSPORT. WHEAT AND MINERALS ARE BULK LOADED STRAIGHT INTO THE SHIP'S HOLDS BY MODERN CONVEYOR SYSTEMS OPERATING FROM BERTHS No 5 AND 4 RESPECTIVELY.

RAIL SERVICES

FULL RAIL FACILITIES ARE AVAILABLE ON BERTHS No 1, 2, 3 & 4. THE RAIL TRACKS ARE CONNECTED WITH THE RAILWAY SYSTEM OF THE SOUTH WEST OF WESTERN AUSTRALIA.

FRESH WATER

AVAILABLE FROM ALL BERTHS.

OIL SERVICE POINTS

PROVIDED AT No 2 BERTH FOR THE DISCHARGE OF REFINED PETROLEUM PRODUCTS.

ELECTRICAL SERVICES

THE FOUR LAND BACKED BERTHS, No 5 BERTH, FISHING BOAT WHARF & MOORING PENS ARE FLOODLIT. 150A 3 PHASE 440V 50Hz OUTLETS ARE SUPPLIED ON ALL BERTHS. A 20A 3 PHASE 440V 50 Hz OUTLET IS SUPPLIED ON THE FISHING BOAT WHARF. 10A SINGLE PHASE 250V 50Hz OUTLETS ARE SUPPLIED ON THE FOUR LAND BACKED BERTHS, No 5 BERTH, FISHING BOAT WHARF & MOORING PENS.

ROAD SERVICES

CONNECT THE WHARF WITH THE TOWN AND THE STATE ROAD NETWORK.

REPAIR FACILITIES

GERALDTON WORKSHOPS CAN EFFECT LARGE SCALE REPAIRS.

PORT OPERATING AUTHORITY

GERALDTON PORT AUTHORITY.

TIDE DATA

AN AUTOMATIC TIDE RECORDER IS INSTALLED AND MAXIMUM AND MINIMUM TIDES RECORDED SINCE 1961 ARE +2·1m AND 0·00m RESPECTIVELY. PREDICTIONS ARE AVAILABLE.

PILOTAGE

PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER.

METEOROLOGICAL DATA

RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATIONS.

REFERENCE PLANS

REFERENCE PLANS	P.W.D., W.A.
BERTHS:	
NO 1, 2 & 3	25711, 53688, 52431
NO 4	38193, 52431
NO 5	50020
FISHING BOAT HARBOUR	38931
BREAKWATER	24098
SLIPWAY 511	53687
SLIPWAY 71	38838
PORT BOUNDARY & LEASES	50370, 48147
SOUNDINGS	49890, 46131
HYDROGRAPHIC SURVEY 1980	52474
NAVIGATION AIDS	51324
DREDGING	COMPOSITE SURVEY COMPUTER BINDER FILE NO 81
ADMIRALTY CHARTS	AUS 81, 332 & 333 BA 1033, 1056

100 50 0 100 200 300 400 500 600 700
SCALE OF METRES (1:20 000) (1)

5 000 0 5 000 10 000 15 000
SCALE OF METRES (1:500 000) (2)

#	DATE	REVISION	DRN	APPD

S/RVEY BOOKS | FILE No | PW 1248/65

GENERAL NOTES

UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES.

1. SEE DRG 53923-7-2 FOR LEASES.
2. SEE DRG 53923-7-3 & -7-4 FOR CROSS SECTIONS AND DESIGN LOADINGS.

REVISED TO DEC 31, 1983

SCALES AS SHOWN
MICROFILMED
DATUM
AS SHOWN

DESIGN CALC. BOOK
CHECKED BOOK
DRAWN C.S. CHECKED CS/JMB
TRACED CHECKED
SUPERVISING DESIGN ENGINEER, H.&R.
SUBMITTED DATE 29.12.83
DESIGN E.
APPROVED DATE 24-1-84
CHIEF HARBOUR

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF GERALDTON
LOCALITY PLAN AND SERVICES DATA

P.W.D. W.A. 53923-7-1

REV'N

19 Geraldton

Early History

Geraldton was declared a port in 1855 and the first jetty was built opposite Gregory Street (at the northern end of the current No 1 harbour berth) in 1864. In 1865 the jetty was extended to a length of 300 feet into a 9'6" depth of water, with a 61 feet by 49 feet berthing head. This jetty was extended in 1872, 1875 and 1883. In 1890 a second jetty was built at Durlacher Street in 1893 and extended in 1895. The jetty, known as the North Jetty or Railway Jetty then had a total length on 915 feet.

A scheme for major improvements to the port which included the deepening of the harbour, the building of protective breakwaters and the construction of three land backed berths, was adopted in 1914.

Between 1914 and 1917 a 3,154 feet length island breakwater was built off from the end of the jetty with the rock for the breakwater being transported on rail truck on a specially built 4,200 feet length viaduct. By 1922 the North Jetty was 2,250 feet long with two berths at the head. In 1923 a second 600 feet length island breakwater was constructed on the east side

The breakwaters were also to give protection to the floating plant in the dredging phases in the construction of the harbour. .

On the completion of the breakwaters and the dredging of the harbour using the departmental bucket dredge Sir William Mathews and the cutter suction dredge Governor, the three 450 feet concrete land backed berths within the protection of the breakwaters were constructed.

The resident engineer on this project was Cyril Morgan with Norm Henry as his assistant. The Engineer Harbours and Rivers in the early stages of construction was EH Carlin who was succeeded by JS Young in 1925.

Harbour Development 1960s

Since the completion of the 1350 feet length of land backed wharves in the 1930s very little port improvements took place until 1962 when a contract was awarded to Dredging Industries WA for the dredging of part of the harbour basin required for the next land backed berth (No 4) which comprised concrete filled octagonal steel piles and a reinforced concrete deck supported on longitudinal steel beans .and steel headstocks. This berth was built by the Harbours and Rivers day labour oganisation between 1964 and 1967 under the supervision of resident engineer Max Thorbjornsen. The Engineer, Harbours and Rivers was Norm Henry who was succeeded by John Gillespie in 1965,

The reinforced concrete deck incorporated two railway tracks and rails for the iron ore ship loading gantry. The reclaimed fill behind the berth was

retained by steel sheet piling tied back by steel tie rods to concrete anchor blocks. The timber fendering matched the fendering of the earlier berths.

Construction by the Department commenced in July 1964 and was completed on schedule in February 1966 All associated dredging was completed in January 1967. The ore loading facilities were designed and installed by the Western Mining Corporation. A troublesome problem occurred with wind blown sand from the new reclamation area. This was alleviated by spreading 22,000 cubic yards of loam and planting clover, rye, and lupins. In March 1966 Premier Brand officially opened the new facilities and dispatched the first commercial iron ore cargo from Australia to an overseas destination.

A 300 feet length steel sheet pile wharf for fishing vessels was built at the western end of the main harbour in 1961

In 1971.72 further drilling and blasting of the rock areas in the Geraldton harbour approach channel continued... Between November 1970 and January 1971, 140,000 cubic yards of material was removed by the Westminster trailing suction hopper dredge WD 53.

The capacity of the Geraldton Fishing Boat Harbour then was for 300 boats of, which 94 were moored in pens.

In 1972/73 drilling, blasting and removal of the rock floor in the harbour to increase the depth of the basin and approach channel to 32 feet below low water continued.
A further 16 boat pens were completed in the fishing boat harbour to provide pens for 110 vessels.

Between 1973 and 1975 Westham Dredging Company's trailer dredge WDA Endeavour was engaged for removing material from the harbour bed.

In 1974 an assessment was made of the deteriorated condition of the original berths 1, 2 and 3 which were built in the 1930s and reconditioned in 1960. The result was a substantial reduction in the permissible loadings on the deck. These restrictions meant the transfer of all cargo carrying vessels, except oil tankers, from berths 1, 2 and 3 to No. 4 berth.

Consulting engineers G.B. Hill and Partners Pty Ltd were engaged to recommend extensions to the existing wharves. They proposed a new berth at the western end of the harbour almost at right angles to the existing wharf alignment. With some modifications their proposal was adopted and a decision was made in 1975 to proceed with the construction of a heavy duty all purpose berth. Work commenced on site preparations in August 1976 and G.B. Hill was engaged to design the berth structure.

Dredging was undertaken between August 1976 and July 1977 by Deepsand Dredging Pty Ltd. The driving of the tubular steel piles was carried out departmentally in early 1977 and the flat slab concrete deck

was constructed for $1,169,641 by J.D. Clough and Son Pty Ltd between July 1977 and August 1978. The electrical design was undertaken by Merz and McLellan and Partners.

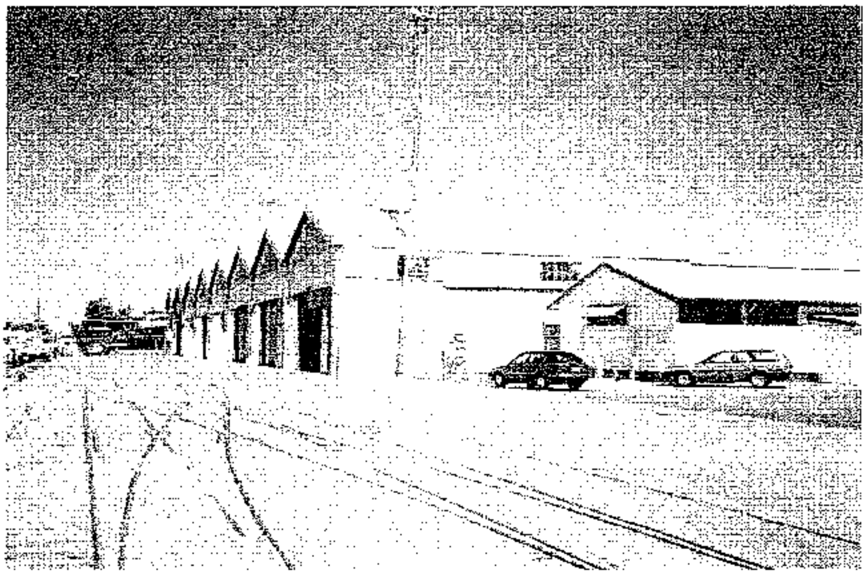
No5 berth was 213 metres long and 13 metres wide, with three 15 metre wide approach ramps leading to the wharf apron. The tubular steel piles were sleeved with concrete to just below low water mark and were fitted with sacrificial anodes to resist corrosion below the concrete sleeves. Seventy tonne capacity mooring dolphins were located at each end of the berth. The structure was designed to accommodate vessels up to 27,000 tonnes displacement, with a water depth at the berth of 9.4 metres.

The first ship to use the facilities was the *Golden Sari Ion* December 22nd 1978.

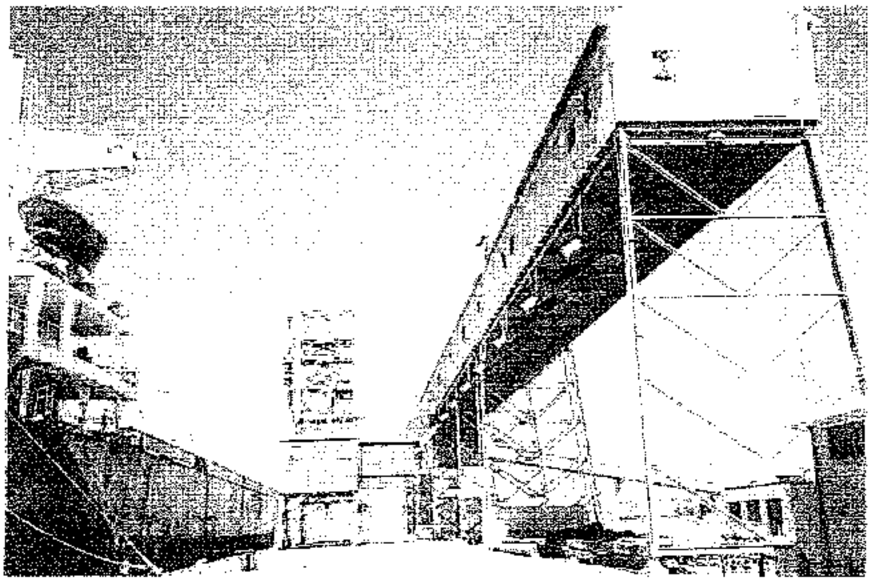
The berth was officially opened by Premier Court on April 6th 1979. In 1982 a large accommodation module built at the rear of the berth for the North West Shelf gas platform was transported across the No. 5 berth to an ocean going barge. Despite the loads being substantially in excess of the design parameters for the structure, it withstood the overloading with very little visual or measured indications of distress.
The fishing craft facilities at the extreme western end of the harbour were augmented in 1977-78 by a southward extension to the land backed fishing boat wharf and a new jetty at the northern end of the harbour. In 1979 five patented 'Sarus' towers were manufactured to mark the approach channel to Geraldton Harbour. Problems of excessive wear on the swivel joint of the towers were not long in becoming apparent, due to a large amount of oscillation. The joints had to be replaced by new ones which were designed departmentally. In 1980-81 a section of the old No. 1 berth was upgraded for heavy duty lifts, the No.3 berth was strengthened for continuing use by the bulk grain shiploader and a jetty was constructed for the Harbour and Light Department.

The upgrading of the fender system on No4 berth was completed and the five Sarus Towers, defining the entrance channel were modified, repainted and re installed

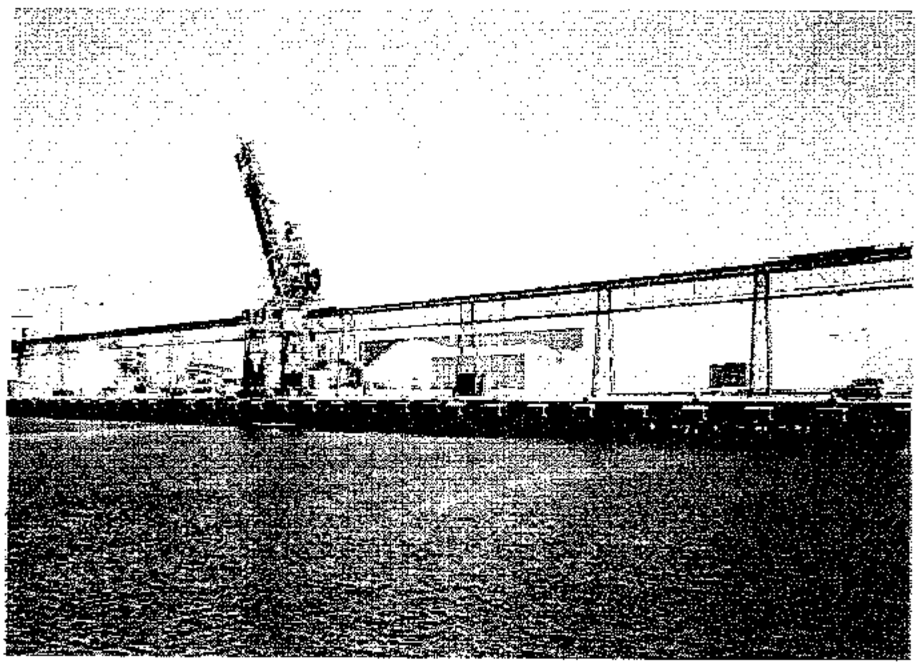
Between 1982 and 1985 the grab dredging of shoal areas in the inner approach channel was carried out. Several modules for the platform for the Rankin "A" gas pipeline for the North West Gas Shelf project were shipped out of Geraldton over the No 5 berth.



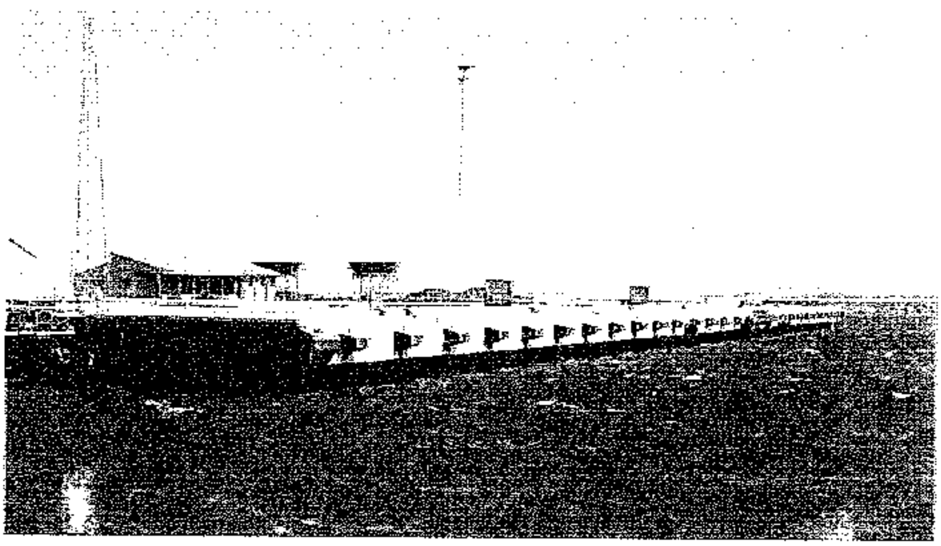
Geraldton Harbour - No 1 Berth, 99m in length and No 2 berth, 203m in length comprised concrete cluster piles with cast insitu reinforced concrete transverse and longitudinal beams and light deck. The structure was designed initially for rail traffic and constructed in the 1930s.There was a 3000 m2 cargo shed located immediately behind the No 1 berth. The depth of water at this berth was 8.8m at LWM. and at the No 2 berth it was 9.4m at LWM



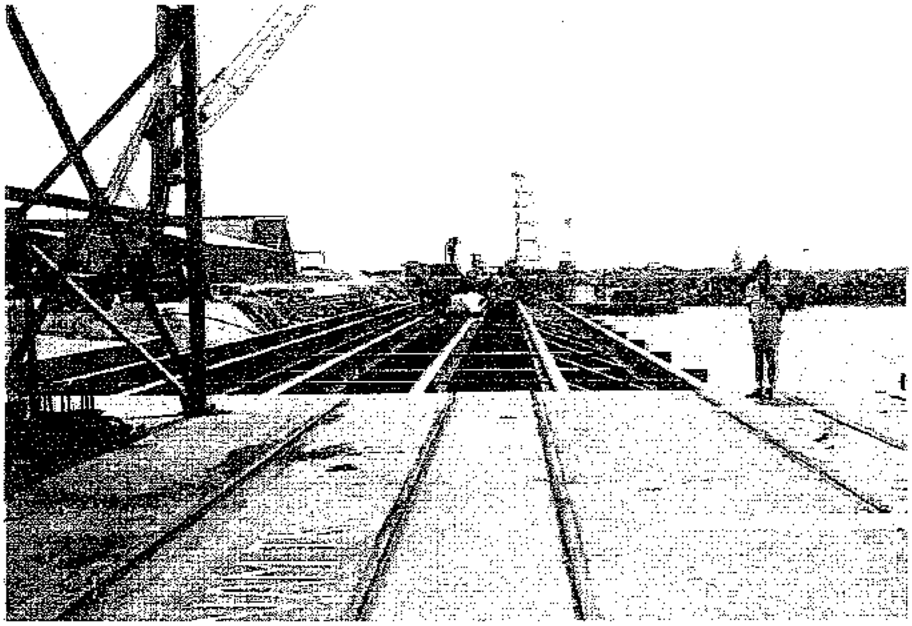
Geraldton Harbour -No 3 Berth, 203m in length with a depth of water at the berth of 9.4m was of the same construction and age as No 1 and 2 Berths. Two grain bulk loading ship loaders each rated at 500tph were located at this berth



Geraldton Harbour - No 4 Berth, constructed in 1964 comprised steel tubular piles, transverse and longitudinal steel beams and reinforced concrete deck. The berth was extended in 1987 by 100m to give an overall length of 281m. The berth had bulk loading equipment for the export of mineral products with a travelling shiploader rated at 1000tph. Depth of water at the berth was 9. 4m at LWM...



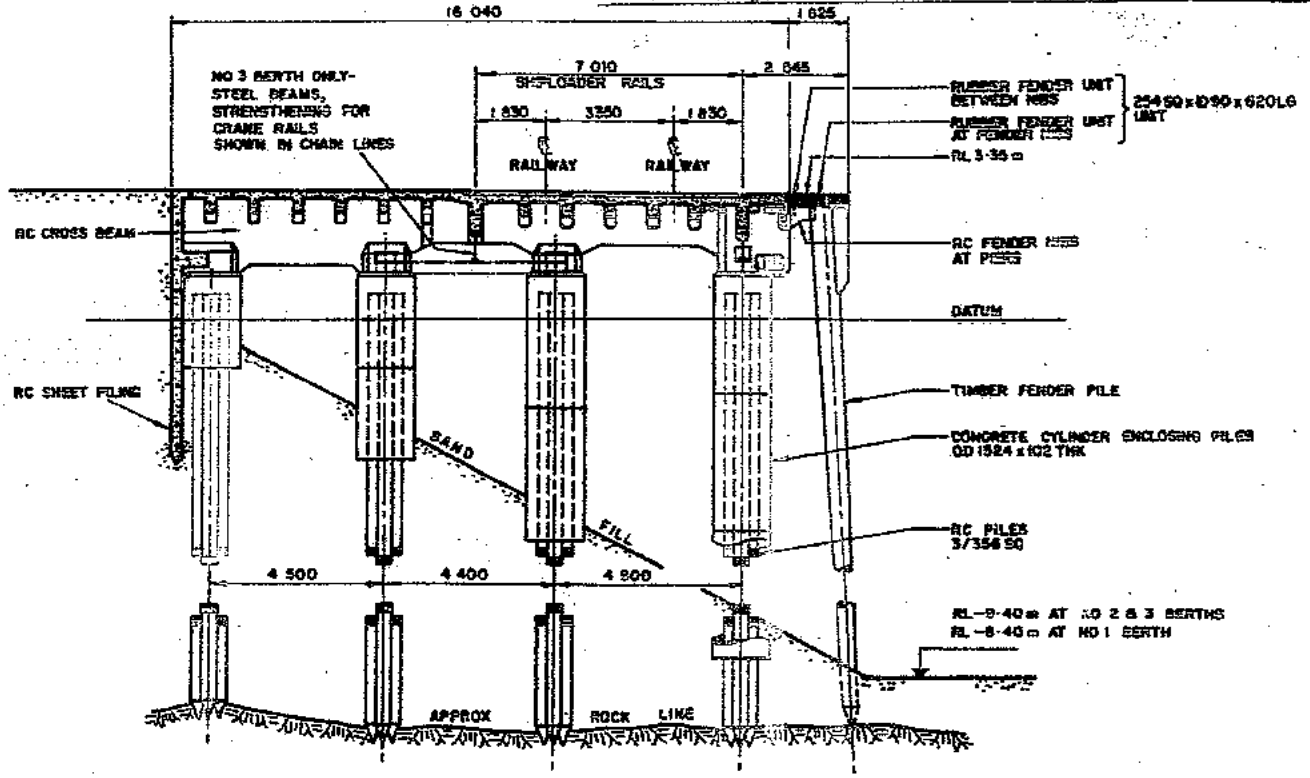
Geraldton Harbour - No 5 Berth, which was constructed in 1978, comprises steel tubular piles, which are partly concrete sleeved, and a heavy reinforced concrete deck. The berth was 213m long and had a depth of water of 9.4m at LWM, - The berth was designed to take a travelling ship loader, The Seibu rubber dock units on the fender system were designed to take a berthing load from a vessel of 27,000 tonnes loaded displacement.



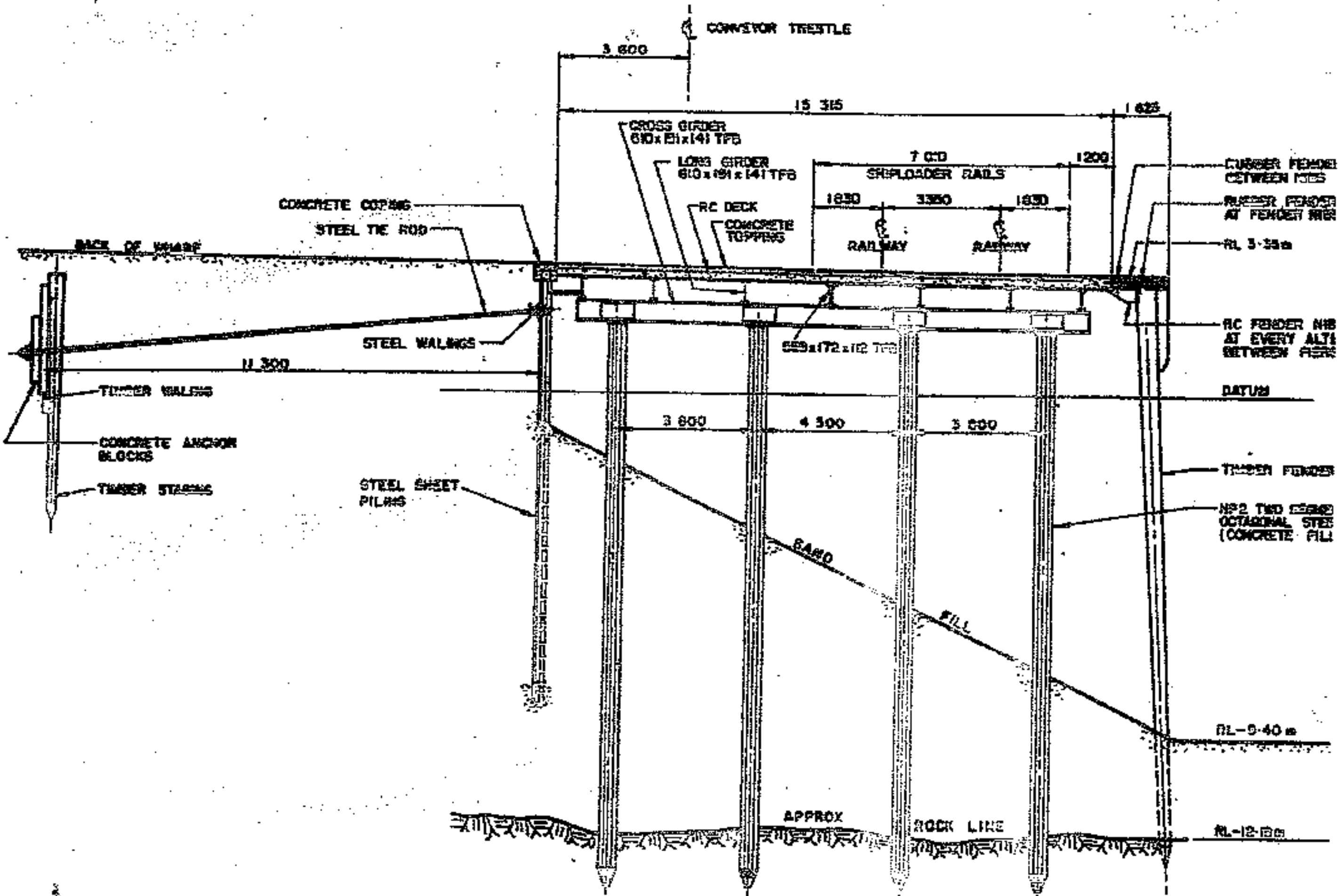
The 100 metre extension of Geraldton No 4 Berth under construction in December 1987 - undertaken by the Geraldton Port Authority organisation

Mooring pens and service jetty in the Geraldton Fishing Boat Harbour

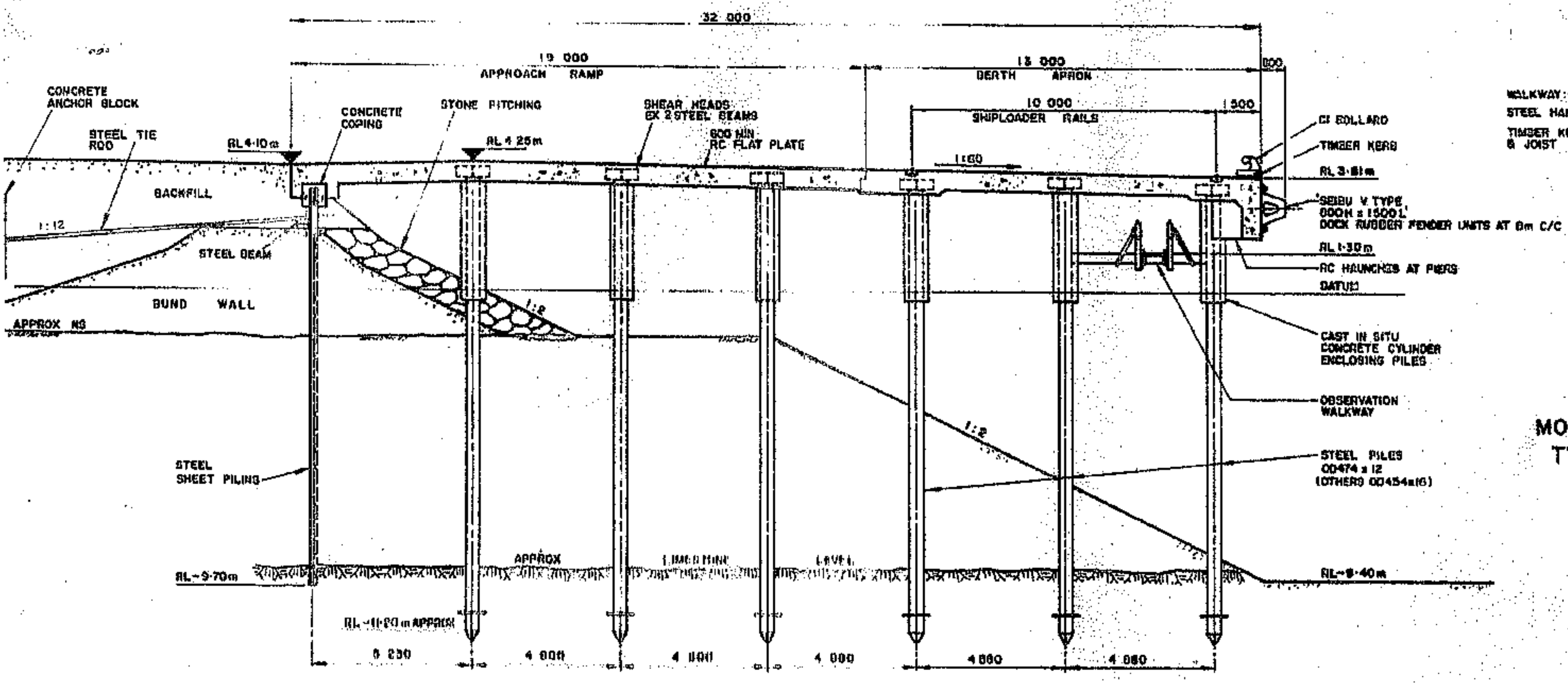
CROSS SECTIONS OF No 1, 2, 3 and 4 BERTHS



PORT OF GERALDTON
CROSS SECTIONS OF BERTHS 1, 2, 3 AND 4



No 4 BERTH –
TYPICAL CROSS SECTION
(PIERS AT 7 010 CENTRES)



WALKWAY:-
STEEL HANDRAILING
TIMBER KERB, DECK & JOIST

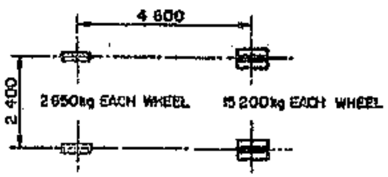
MOORING
TYPICAL

No 5 BERTH
TYPICAL CROSS SECTION AT
APPROACH RAMP & BERTH APRON (1)
(PIERS AT 4 270 CENTRES)

DESIGN LOADINGS ON No5 BERTH

(A) STACKED LOADS
4500 kg/m²

(B) CRANE
HEAVY FORK LIFT 27 200 kg LIFT CAPACITY
"TOWMOTOR" MODEL AH 60. (No 3 BERTH ONLY)



(C) BERTHING LOAD
27 000 TONNE VESSEL (LOADED DISPLACEMENT MASS) AT 0·15 m/s,
50% OF KINETIC ENERGY ABSORBED BY STRUCTURE.

PORT OF GERALDTON
CROSS SECTION OF BERTH 5

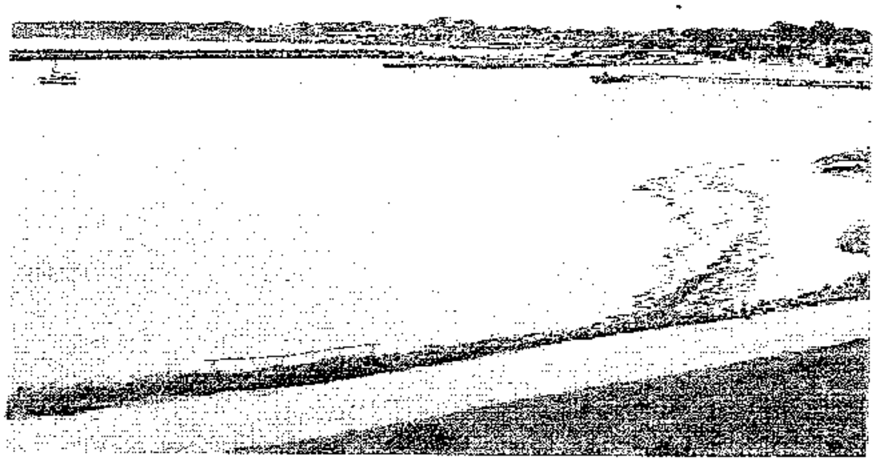
Port Denison Small Boat Harbour 2007

google earth

20 Port Denison

Port Denison is located 359kms north of Perth and is a popular holiday destination noted for its fishing and aquatic activities. Dongara is three kilometres from Port Denison.
In 1973 investigations commenced at Leander Point, Port Denison for the building of a small boat harbour.

In 1978 the construction of a fishing boat harbour at Leander Point Port Denison commenced with the building of two breakwaters giving a total protective water area of 28 ha. The breakwaters were completed in March 1979 and the harbour officially opened by Minister for Works MacKinnon on June 14th 1979. Following the completion of the protected harbour basin, a heavy duty service jetty, floating dinghy mooring pens and a boat launching ramp were constructed and the service area was sealed.



The northern end of the Port Denison Fishing Boat Harbour showing part of the northern breakwater and the hardstanding area on the right at the foot of the breakwater with boat pens and small craft servicing facilities. The road in the foreground leads onto the southern breakwater at Leander Point,

The harbour has 48 boat pens with three phase power, water and lighting. catering for vessels of up to 23 metres in length and two floating dinghy pens, together with 80 commercial moorings and 23 recreational moorings. There is a 72 metre long jetty, serviced with water, single and three phase power, lighting and fuel including a separate fuelling berth at the end of this jetty and a concrete wharf to assist the fishing industry in loading and offloading fish.

There is a dual concrete boat ramp, with one catwalk and a recreational jetty.

Leeman Small Boat Marine Facilities 2007

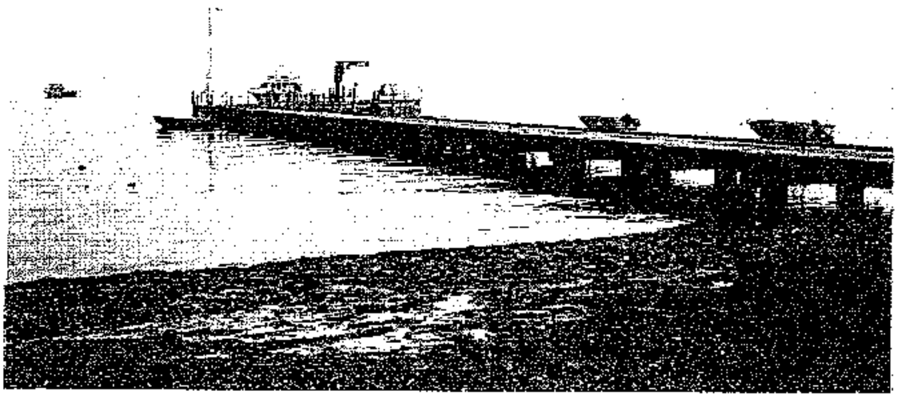
google earth

21 Leeman

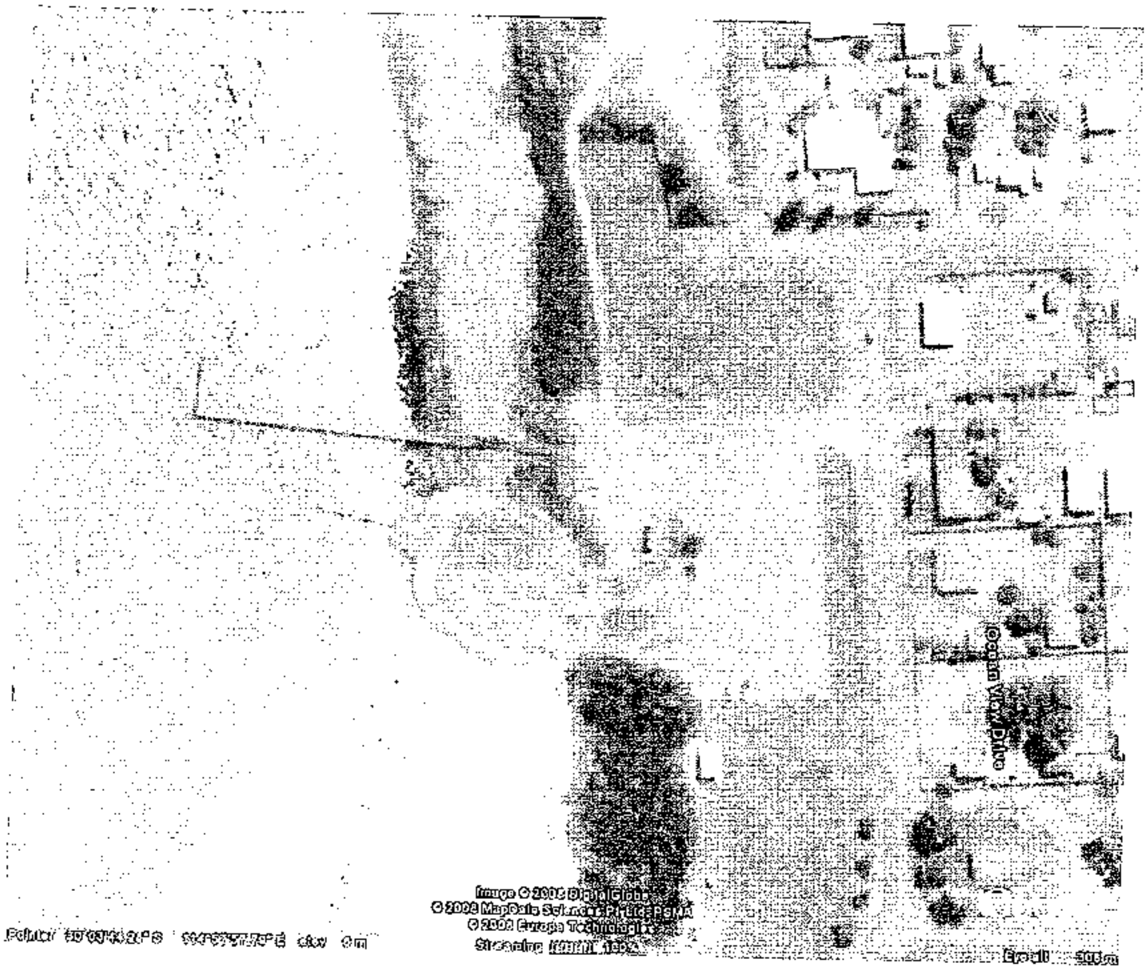
Leeman is a coastal town situated 295 kilometres from Perth, on the Batavia Coast of Western Australia. Leeman's population is 750 people.

The Leeman Maritime Facility consists of one timber service jetty, situated in open waters, with an offshore reef providing limited protection. The L- shaped jetty, constructed in 1982, consisted of steel tubular piles, with timber half caps, stringers and deck with a 20 metre by 6, 5 metre head and a 96 metre length neck.
The jetty has a 2 tonne Trittler hoist on the head, and a low landing located on the inside of the L

The two boat ramps in Leeman are operated by the Shire of Coorow.
One of the ramps, a single lane gravel ramp is located in close proximity to the service jetty and the other, also a single lane gravel ramp, with a catwalk is located at the north end of the town, near the Leeman Sea Search and Rescue building.



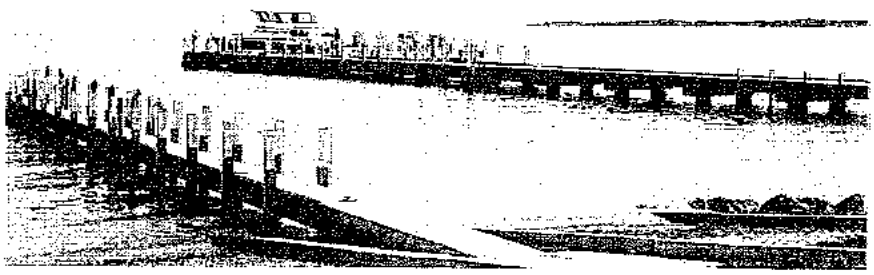
The Service jetty at Leeman



Greenhead Small Boat Marine Facilities google earth

22 Greenhead

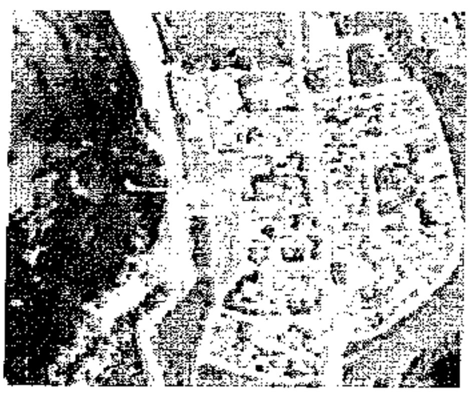
Green Head is a small coastal town situated 288 kilometres north of Perth, in the Shire of Coorow. The town has a population of 230 people, with rock lobster and fishing with a rapidly growing tourism market.
Day and night navigational beacons were installed in 1980 leading to the safe anchorage and a fishing industry jetty was constructed in 1982.

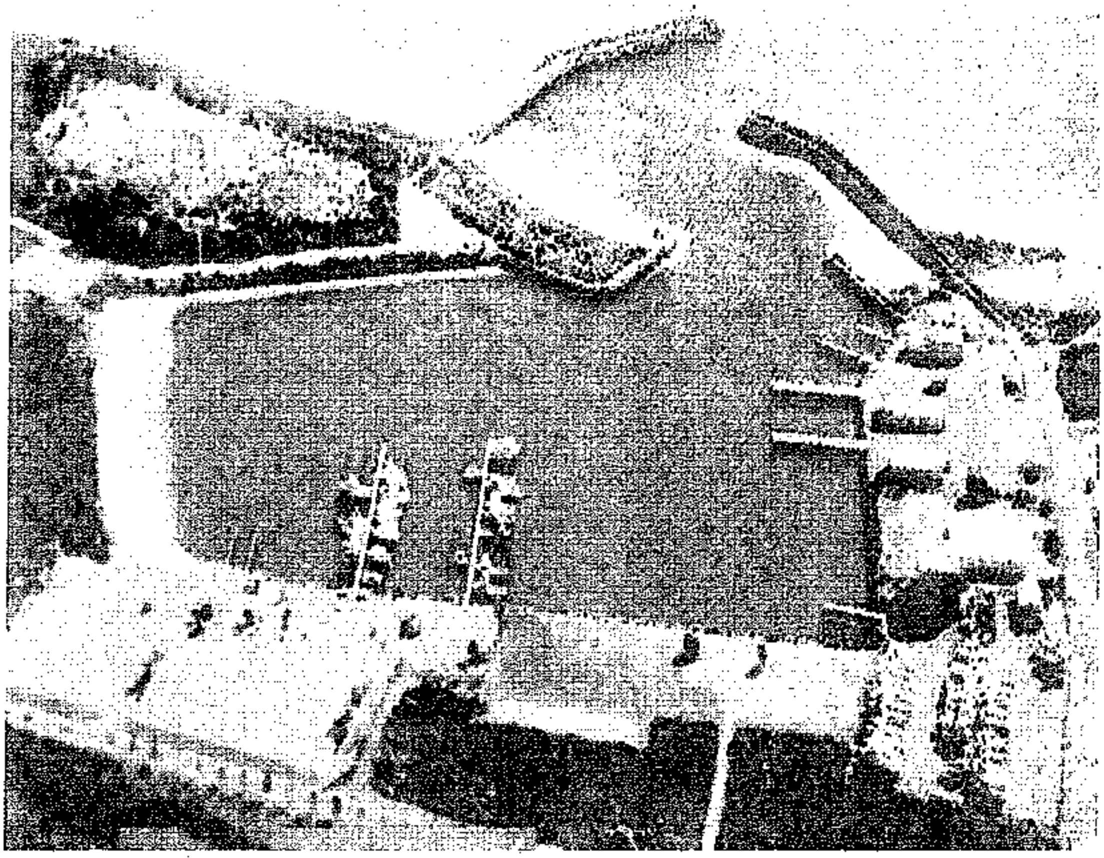


Launching ramp and service jetty at Greenhead

The "L" shaped service jetty consists of steel tubular piles, with timber half caps, stringers and deck with a 20 metre by 20 metre head and a 90 metre long approach neck and has single and three phase power, water and fuel available at the jetty.

A new recreational dual lane concrete boat ramp, with a catwalk, was completed in 2000. There is also another single lane boat ramp with car parking facilities situated at South Bay Green Head. Both ramps are owned and operated by the Shire of Coorow.





Jurien Bay Small Boat Harbour 2006

file copy

23`Jurien Bay

Early History

The town of Jurien Bay, 266 km north of Perth, is a typical seaside resort town devoted to recreational fishing, tourism and professional cray fishing and is situated at the southern end of Jurien Bay which stretches over 9 km from Island Point at the south to North Head. The waters of the bay are sheltered by a string of islands and reefs which lie just off the coast.

Although the coastline around Jurien had been known to Europeans since the seventeenth century it was the French expedition led by Thomas Nicholas Baudin and Louis-Claude Desaules de Freycinet which mapped and named much of the area. In early 1803 two ships - Le Geographe and the Casuarina - sailed up the coast of Western Australia mapping and collecting samples of the local fauna and flora as they progressed. Freycinet, a brilliant cartographic surveyor, took soundings and surveyed Jurien Bay which he named after Charles Marie Jurien of the French Naval Administration. Similarly Mount Lesueur, east of Jurien Bay, was named after Charles Alexander Lesueur, the ship's artist on Le Geographe and Mount Peron was named after the ship's naturalist and botanist, Francois Peron.

The coast was subsequently explored by Phillip Parker King, Lieutenant Arthur Preston and James Gregory but, in spite of their excellent maps, it continued to be a veritable graveyard of wrecks. There were three major wrecks off the coast in the 1890s alone and the boiler of the steamship Lubra, which sank in January 1898, can still be seen at low tide between Favourite and Osprey Islands.

First settlement of the Jurien area occurred in the mid 1850s when Walter Padbury, a self made millionaire, took land around Jurien Bay. It was Padbury's nephew, John Grigson, who managed the property and became the original pioneer in the area. The success of pastoralism led to the construction of a jetty in 1885 which allowed a more direct and speedy route to the markets for the wool and hides which were produced in the area. By the early 1900s the coastal waters were being fished for dhufish, snapper and groper. This led to the establishment of a temporary fishing village around the Jurien jetty

Development since 1950

. It wasn't until the 1950s that people began to build permanent residences in the area. The townsite was surveyed in 1956 and officially named Jurien Bay on 21 December that year.

By the 1960s it was clear that the town's development was going to be inextricably tied to the crayfish industry. New jetties were erected, an airstrip was constructed so that produce could be flown south to Perth, and factories were built. The reputation of the Western Rock Lobster is

such that the crayfishing is now a multi-million dollar industry sending shipments regularly to Japan and the USA.

Today Jurien's continued success depends on crayfishing and tourism. It is a typical, low-key, 'get away from it all' holiday town with a superb white sand beach and a small shopping centre. There is a considerable retirement element in the town now. It is soon to become the headquarters of a Shire which will incorporate Leeman, Cervantes and Greenhead. The recent construction of a coast road means that residents of these smaller settlements can now travel to Jurien Bay to take advantage of the safe and all-weather fishing conditions which pertain.

Jurien Bay is recognised as the finest location on the central coast for catching snapper, dhufish (i.e. tandan) and baldchin groper. For this reason the WA Deep Sea Classic is held here every year.

Navigational lights were upgraded in 1979/80

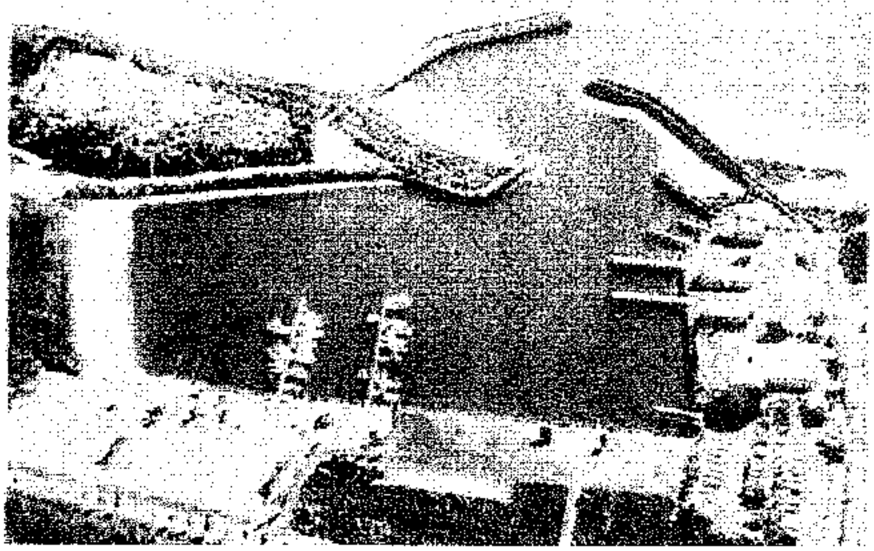
In 1984 the State Government approved the construction of a boat harbour at Jurien, essentially to provide a harbour of refuge and service facilities for the Central West Coast fishing industry. The Boat Harbour was officially opened on 12 November 1988.

In 1985 the construction of a land locked boat harbour similar to that built earlier at Esperance was commenced, comprising two breakwaters of a total length of 580 metres and the excavation of 915,000 cubic metres of material from the inshore mooring and service basin, together with the provision of pens, a service Jetty and launching ramps. It was completed in the following three years, being officially opened on 12th November 1988.

This harbour basin and the one at Esperance were excavated in the dry using standard earth moving equipment. Spears were sunk in the middle of the basin and pumps ran around the clock dewatering the working area. One of the advantages of this method, now widely used in canal development, was that there was no time lost due to adverse sea conditions in the case of normal dredging operations. Also it was possible to complete some of the underwater work in the dry, such as rock pitching of the banks on the harbour periphery. On the completion of the excavation, the area was then allowed to flood and a conventional floating dredge was used to complete the seaward side of the basin and the approach channel

The Boat Harbour was seen to have a broad range of community benefits e.g. recreation, tourism, commercial and industrial development. It is now a fully integrated boat harbour with land backed facilities.

A boat lifting facility opened in 1990 and is now one of the major boat maintenance facilities on the Western Australian coast.



Jurien Bay Small Boat Harbour showing the ocean entrance, the two breakwaters and the mooring basin with service jetties and boat retrieval facilities at lower right and moormg pens and parking areas in the foreground.

There are 69 serviced mooring pens off two fixed catwalk jetties, abutting the eastern foreshore of the harbour. These pens are available for rental on an annual or casual basis.
There are four service jetties in the harbour.

No 1 with a length of 50 metres and a width of 10 metres with 4 single phase and 2 three phase outlets for power, and 2 water outlets

No 2 with a length of 50 metres and a width of 10 metres with 4 single phase and 2 three phase outlets for power, 2 water outlets and 2 fuel outlets.

No 3 a fuel jetty with a length of 38 metres and a width of 4 metres

No 4 the Government jetty with a length of 15 metres and a width of 4 metres. to accommodate DPI and Fisheries WA vessels.

Boat Ramp
A Concrete two lane boat launching ramp, with a catwalk on either side was constructed on the eastern side of the harbour basin.

A number of pens were modified in 1996 so they could accommodate larger vessels.

Cervantes Small Boat Marine Facilities

google earth

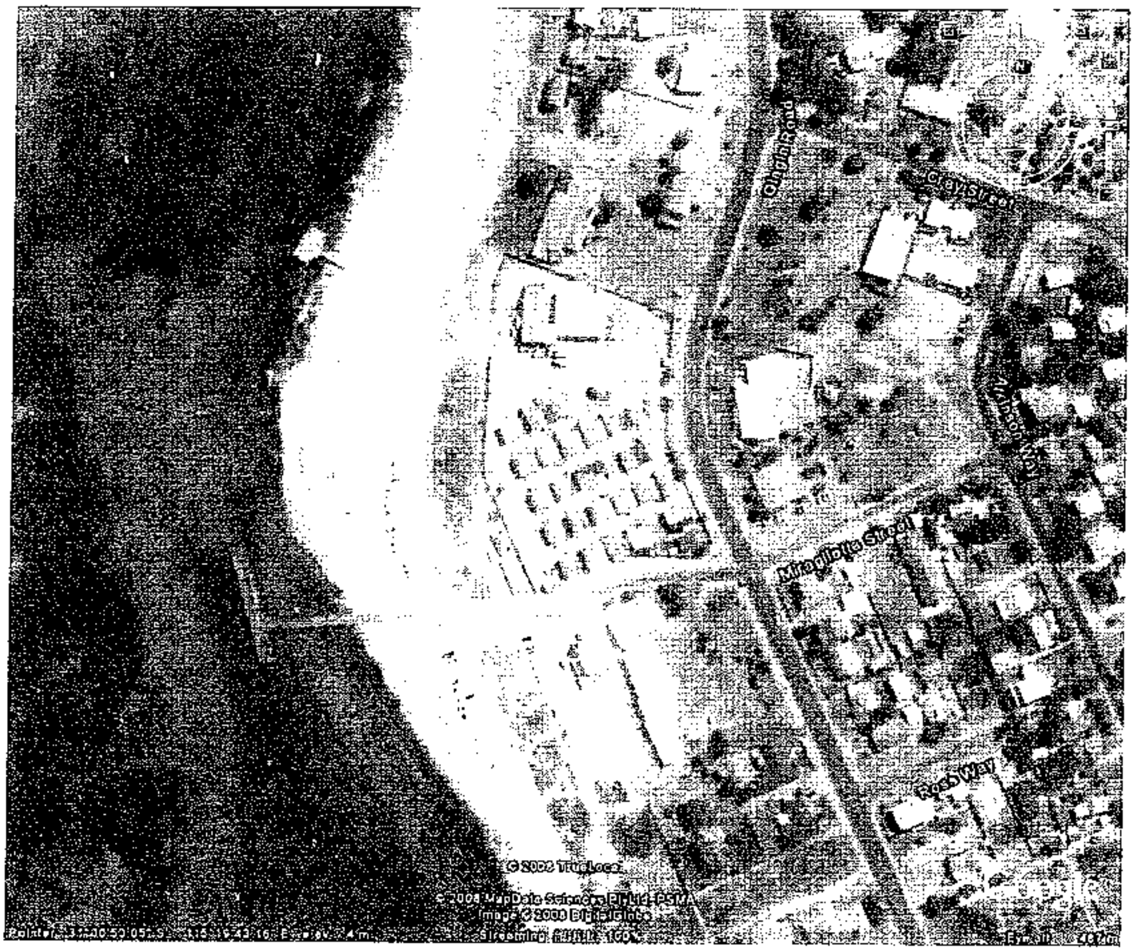
24 Cervantes

Leading beacons were installed in 1978

The Department for Planning and Infrastructure (DPI) recently completed construction of a new Public Jetty in Cervantes. The jetty is designed to accommodate vessels up to 50 Tonnes and can take single unit trucks. Some of the features of the Jetty include:

Fuelling facilities (operated by Comen Pty. Ltd.), water, lighting, single phase and three phase power available and a low level landing, with ramped pedestrian access, for smaller craft had been constructed.

Cervantes jetties with the most recent one on the far left 2008 google earth



Lancelin Small Boat Marine Facilities

google earth

25 Lancelin

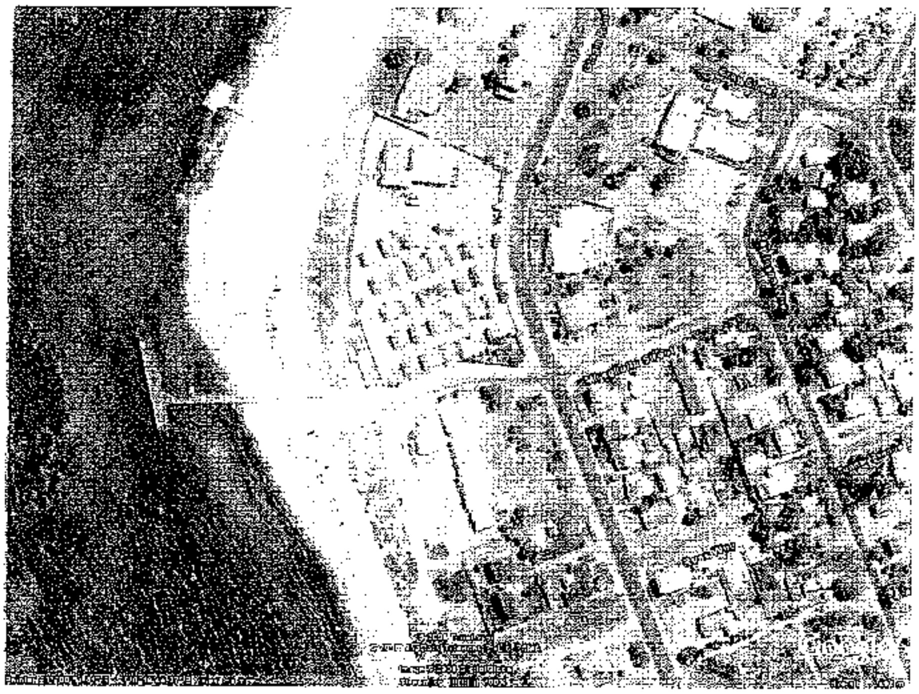
Lancelin is a fishing town 127kms north of Perth. The town is well known as a holiday destination and is the home port for a large number of crayfishing vessels. It is also known for its great windsurfing conditions, attracting many of the sport's enthusiasts.

Day and night navigational beacons were installed in 1980.

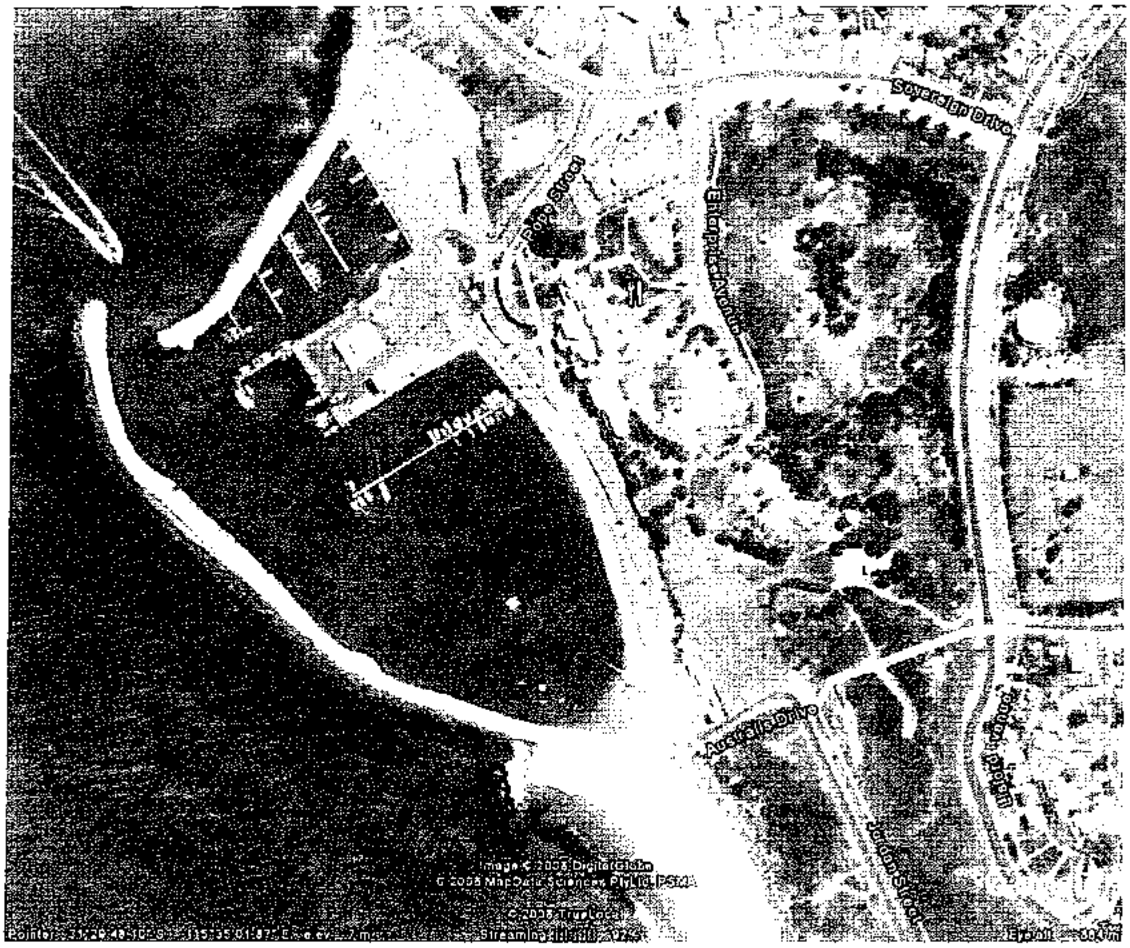
The Lancelin Maritime Facility was established in 1986, with the construction of a service jetty to support the local fishing industry. Jetty construction was completed in November 1986, in time for the 1986/87 rock lobster season.

The concrete "T" shaped service jetty has a :head: 60 m long x 7.8 m wide and an approach neck: 108 m long x 4.5 m wide with single and three-phase power, water, lighting and fuel.

A waste oil installation near the abutment of the jetty consists of a fixed tank with bunding.



Lancelin Jetties 2008 *google earth*



Two Rocks Marina 2007 google earth

26 Ledge Point

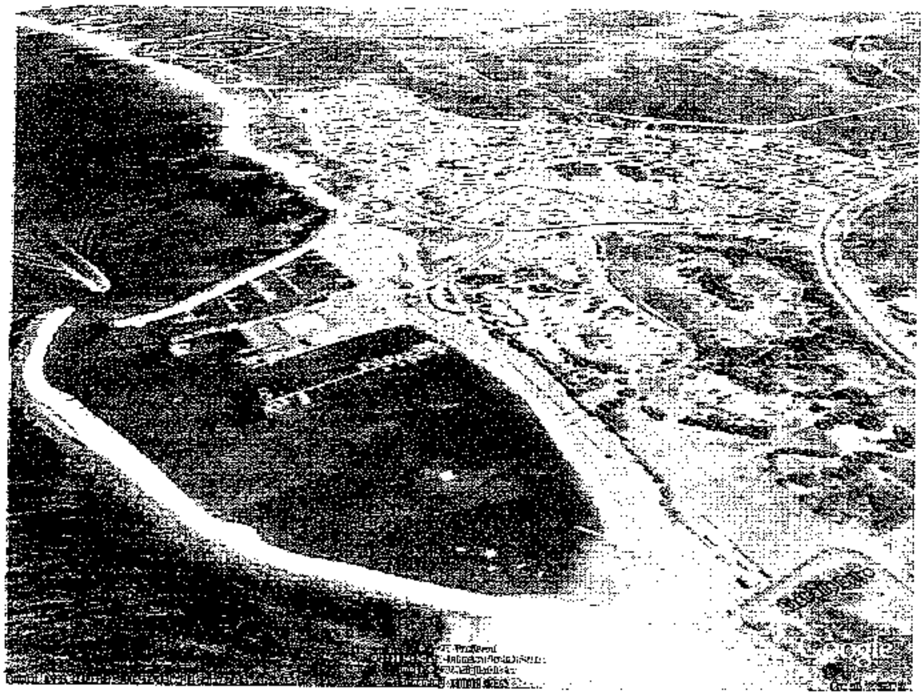
Day and night navigational beacons installed in 1980.
The construction of a rock groyne as a part of a beach protection project was completed in 1985/86

27 Seabird

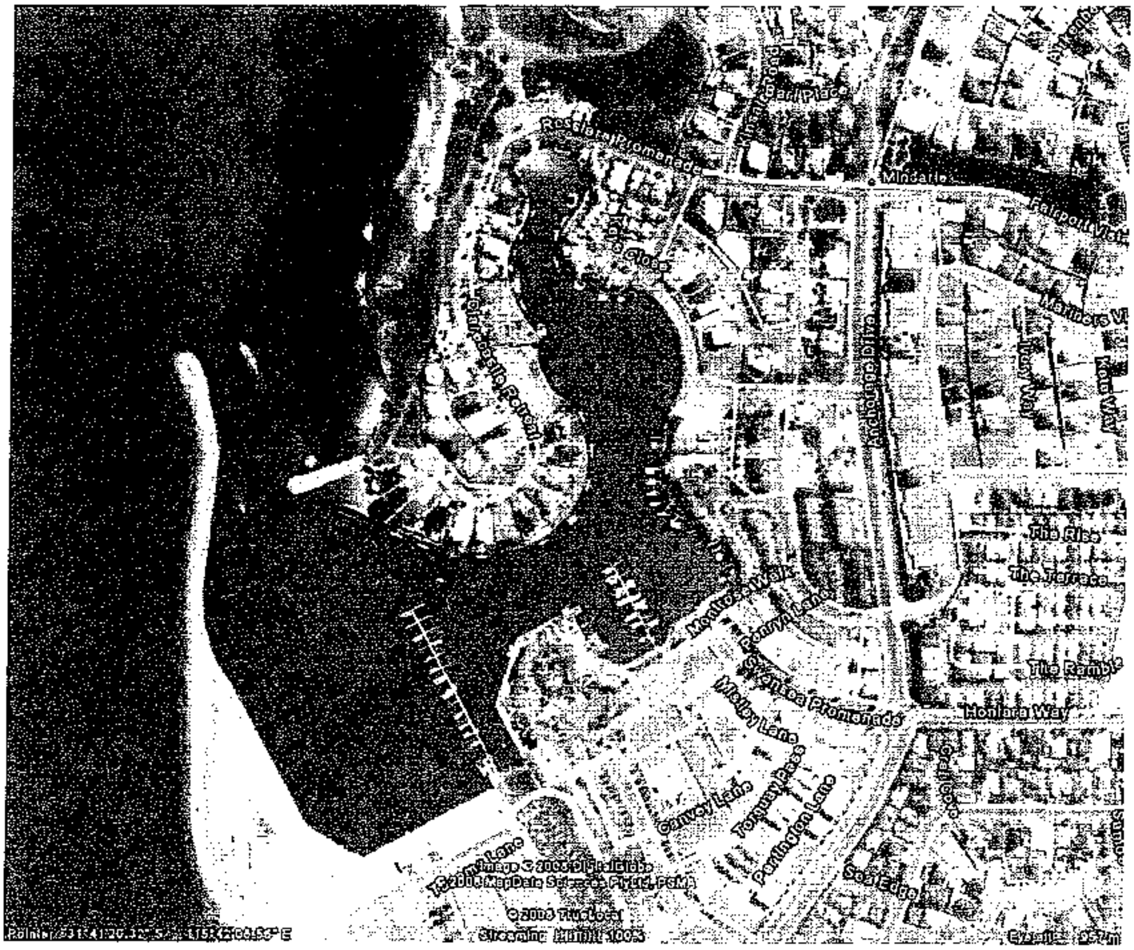
28 Guilderton

29 Two Rocks Marina

This was a private development providing for penning, servicing and maintenance of fishing and recreational craft.



Metropolitan



Mindarie Marina 2007 *google earth*

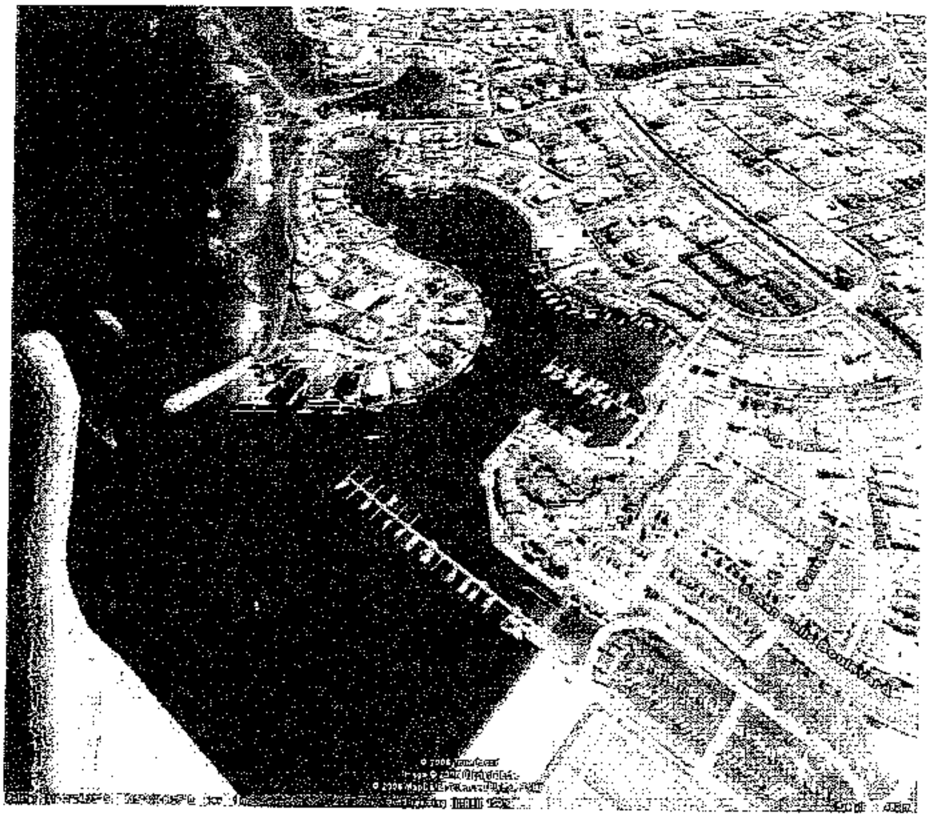
30 Mindarie

The first stage of Mindarie Keys, including the harbour, marina and hotel, was developed by Smith Corporation between 1988 and 1990. However, cost overruns together with unrealistic estimates of the value of the land, the relative isolation from Perth of the development at this stage (Marmion Avenue had not been built beyond Ocean Reef) and adverse market conditions brought on by the late 1980s recession limited the growth and development of both the facility and surrounding residential area.

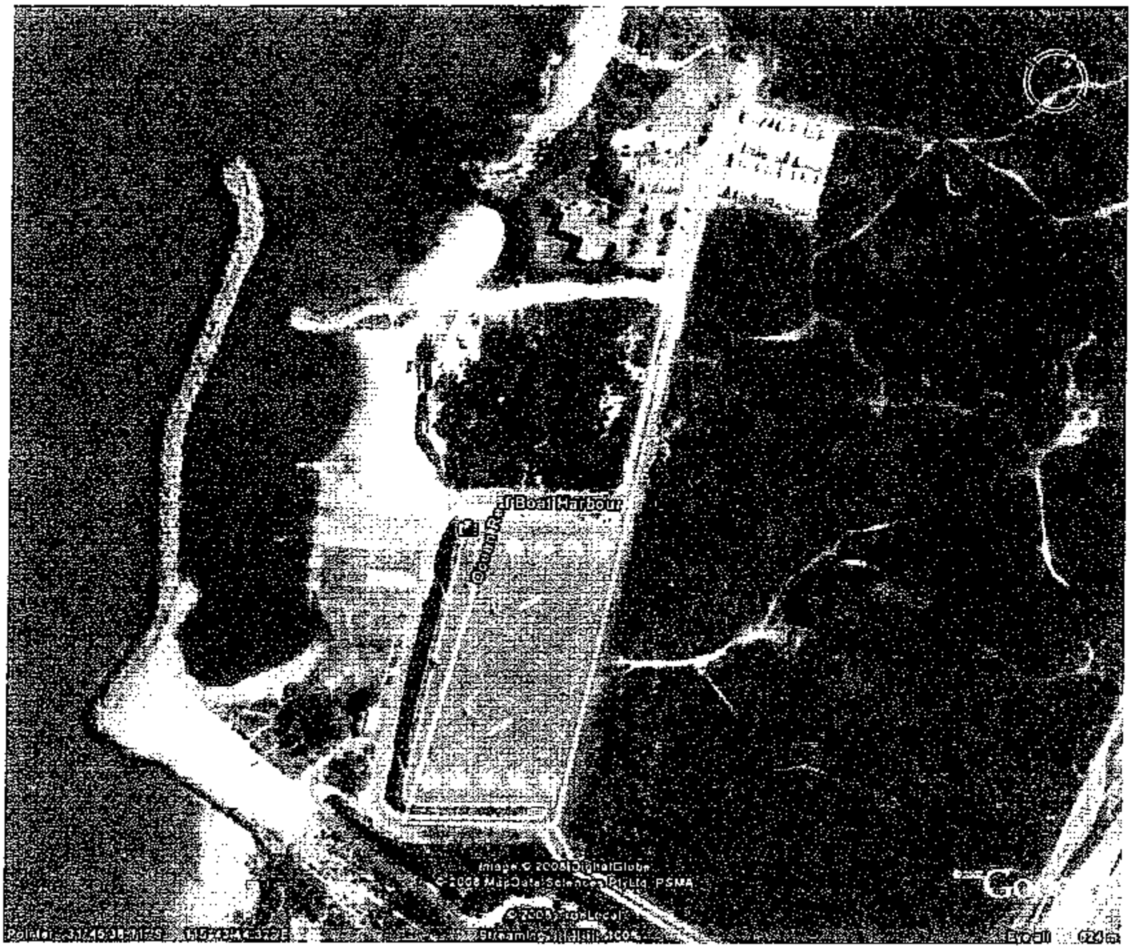
The popularity of Hillarys Boat Harbour to the south and the marina at Two Rocks for mooring was also underestimated in the planning.

Nonetheless, the residential area did eventually come to fruition - the first residents moved in 1987, the hotel opened in May 1989 and by 1998, the west and south of the suburb had been fully developed. The area around the marina is characterised by a number of very exclusive-looking residences with private jetties backing onto the water.

(acknowledgement - Mindarie Wikipedia)



Mindarie Keys where further residential and commercial development is now taking place in the southern part of the marina.

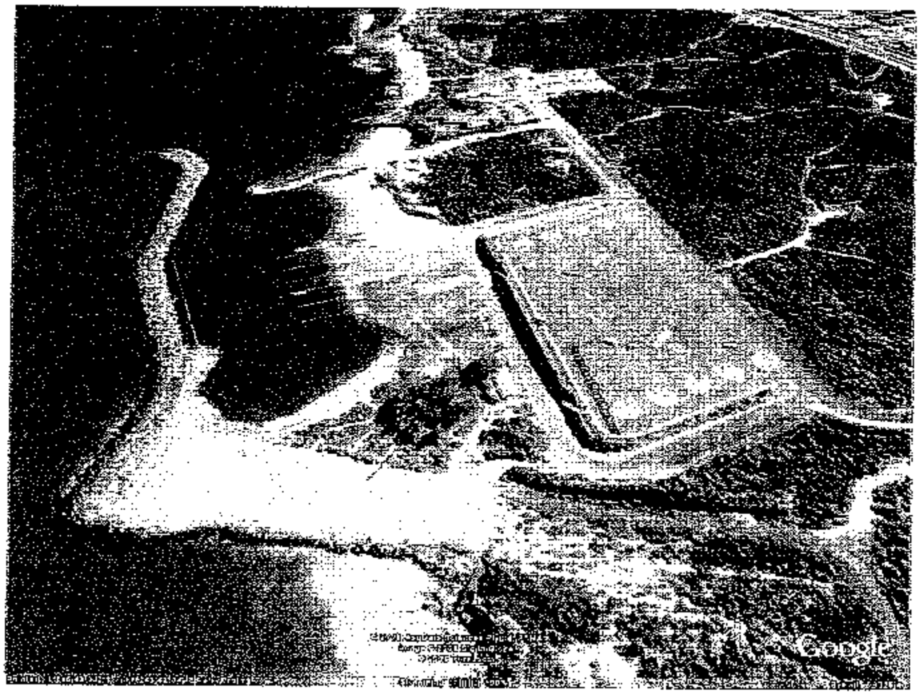


Ocean Reef Small Boat Marine Facilities

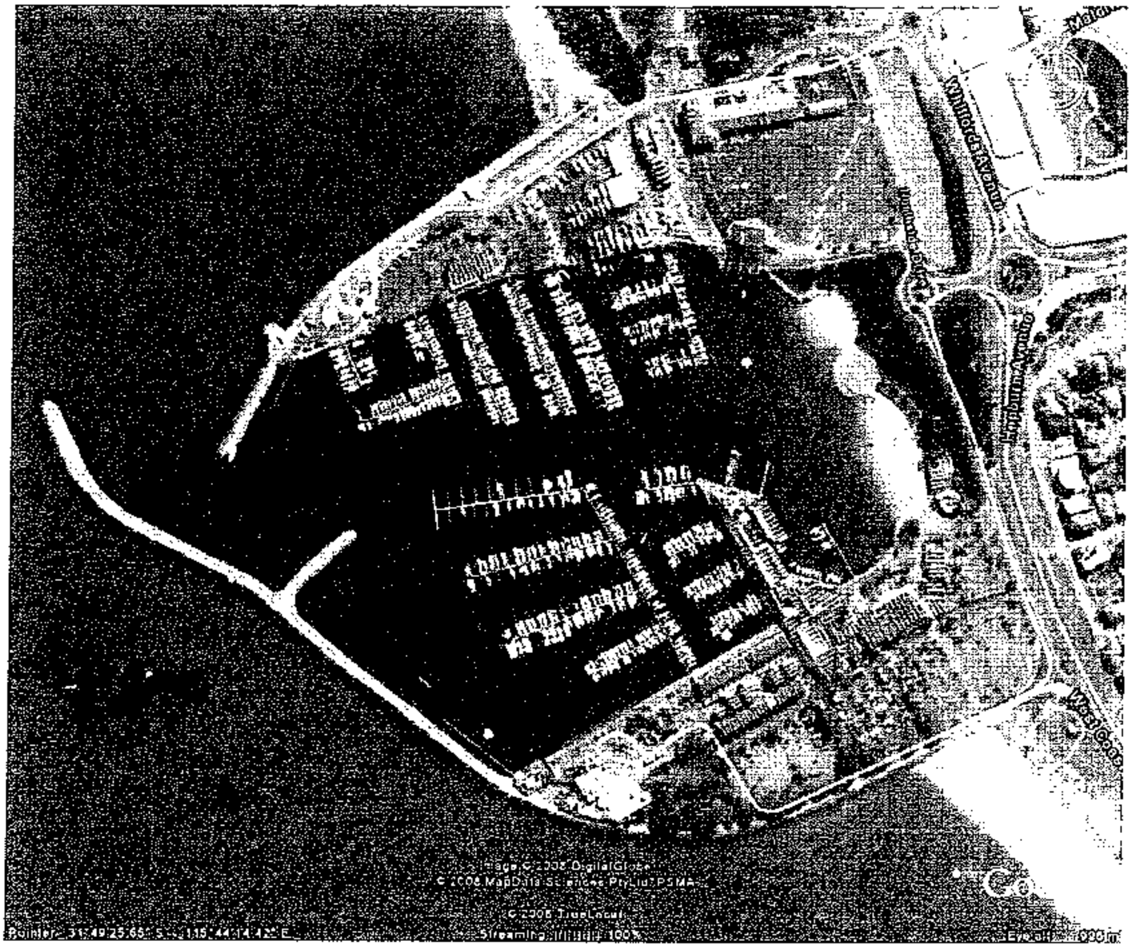
google earth

31 Ocean Reef

In 1978/79 two breakwaters to provide sheltered water for an ocean boat launching facility at Ocean Reef together with navigational aids, a mooring Jetty and launching ramps were constructed



The Ocean Reef Boat Launching Facility



Hillarys Marina *google earth*

32 Hillarys

Hillarys Boat Harbour was the first large marina development in the north metropolitan region.

In the early 1980s the then Harbours and Rivers Branch of the Public Works Department commenced investigations into the development of a boat harbour into the partly sheltered waters of the Marmion lagoon, and one that would be well connected to the regional road system. Some four and a half years of coastal research showed that the Harbour would have a low impact on the adjacent shoreline.

Cost economy was a significant factor favouring the site, but safety of use (particularly in deteriorating weather) and limited environmental impact were also of prime importance.

Construction of the breakwaters for the new Harbour commenced in September 1985. Boat launching facilities were completed in October 1986 and boats started moving into pen moorings two months later, just before the start of the America's Cup Challenge Series.

Located 13 nautical miles north of Fremantle, Hillarys Boat Harbour provided a convenient departure point for visitors to Rottnest. Although primarily a Boat Harbour, the Harbour complex incorporates many community and recreational features to cater for beach goers, tourists and local residents. Its breakwaters are popular for recreational fishing and diving trails are located on the adjoining reefs. Boat launching ramps have been provided, along with parking for more than 2000 cars, convenient cycle paths, walkways and parklands for public use.

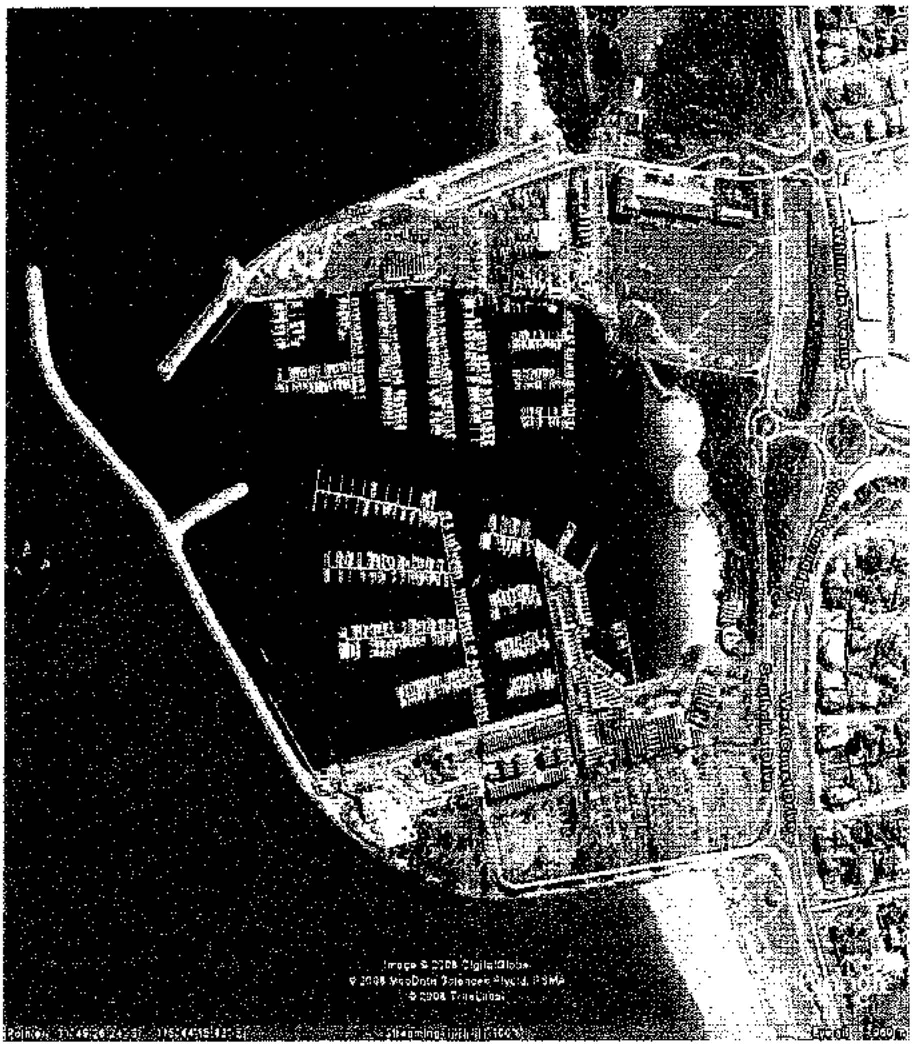
The Hillarys Boat Harbour was officially opened by the then Premier of Western Australia the Honourable Brian Burke on 15 January, 1988.

There are approximately 130 pens taking boats up to 25 metres in length with single phase power, water and lighting. Toilets, showers and telephone located nearby and a 100 metres long wharf equipped with single phase power outlets, three phase power, water outlets and fire fighting units.

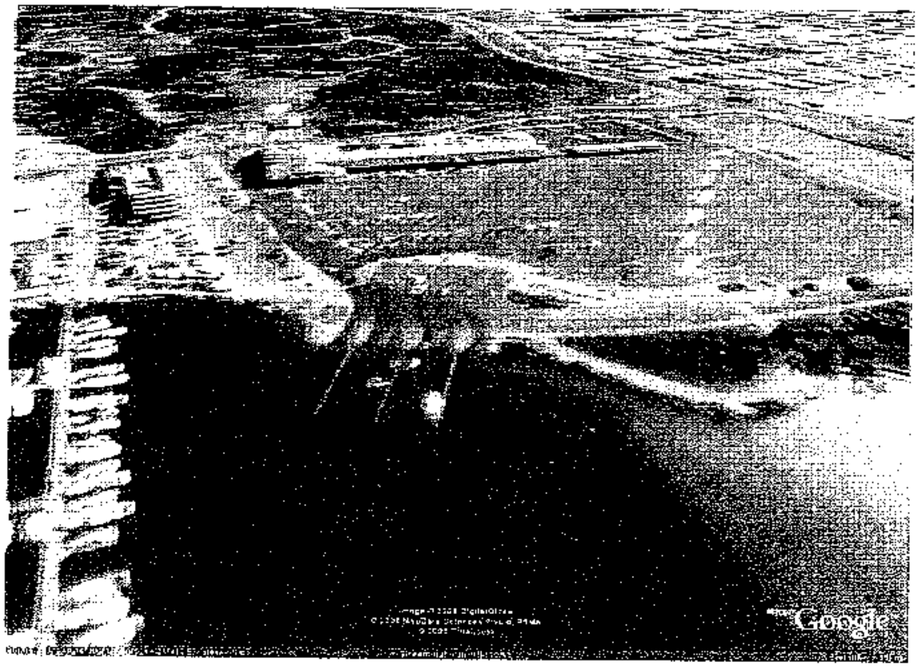
A six lane boat launching ramp with catwalks, to facilitate launching or retrieval of trailerised vessels was provided in the harbour, The launch ramp access roads are one-way traffic to avoid congestion. A wash down facility is also provided and maintained on the exit road.

A lay by mooring area was provided immediately to the east of the boat ramp, consisting of four pylons and mooring ropes. A boat lifting, storage and maintenance facility and Chandlery are located next to and west of the boat launching ramps.

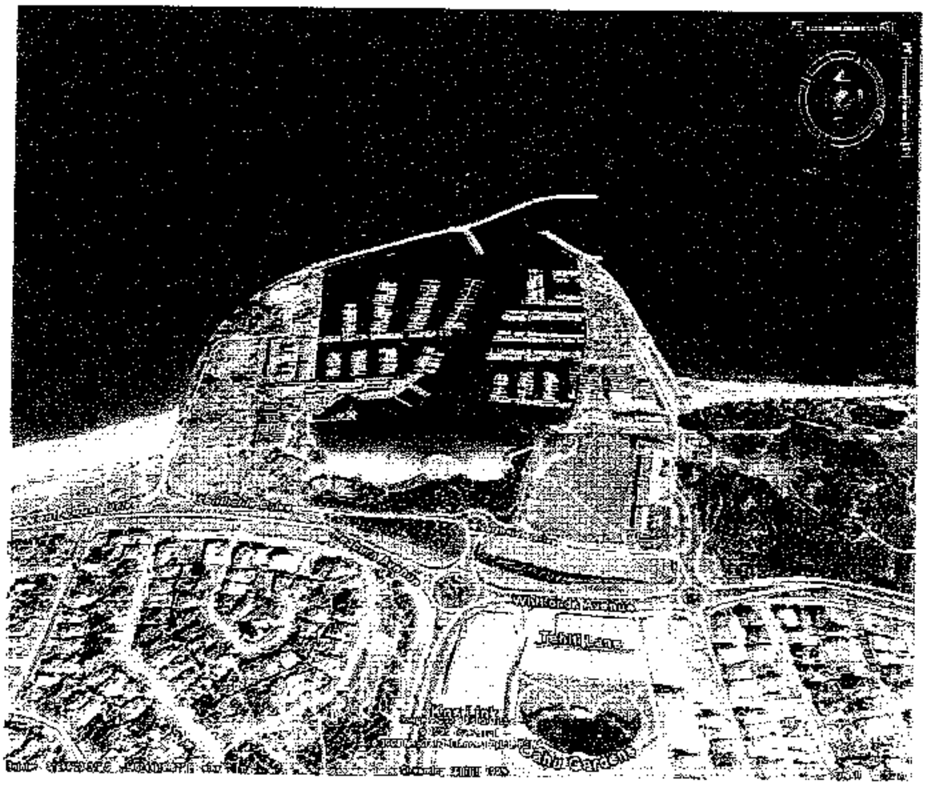
A fifty metre long and 2 metre wide jetty was built on the north side, immediately inside the Harbour entrance for vessel refueling purposes. Private operators run the site and they are open between 7.00am and 5.00pm seven days a week. Diesel and unleaded petrol is available. A small cafe is also operated at the fuelling jetty site.



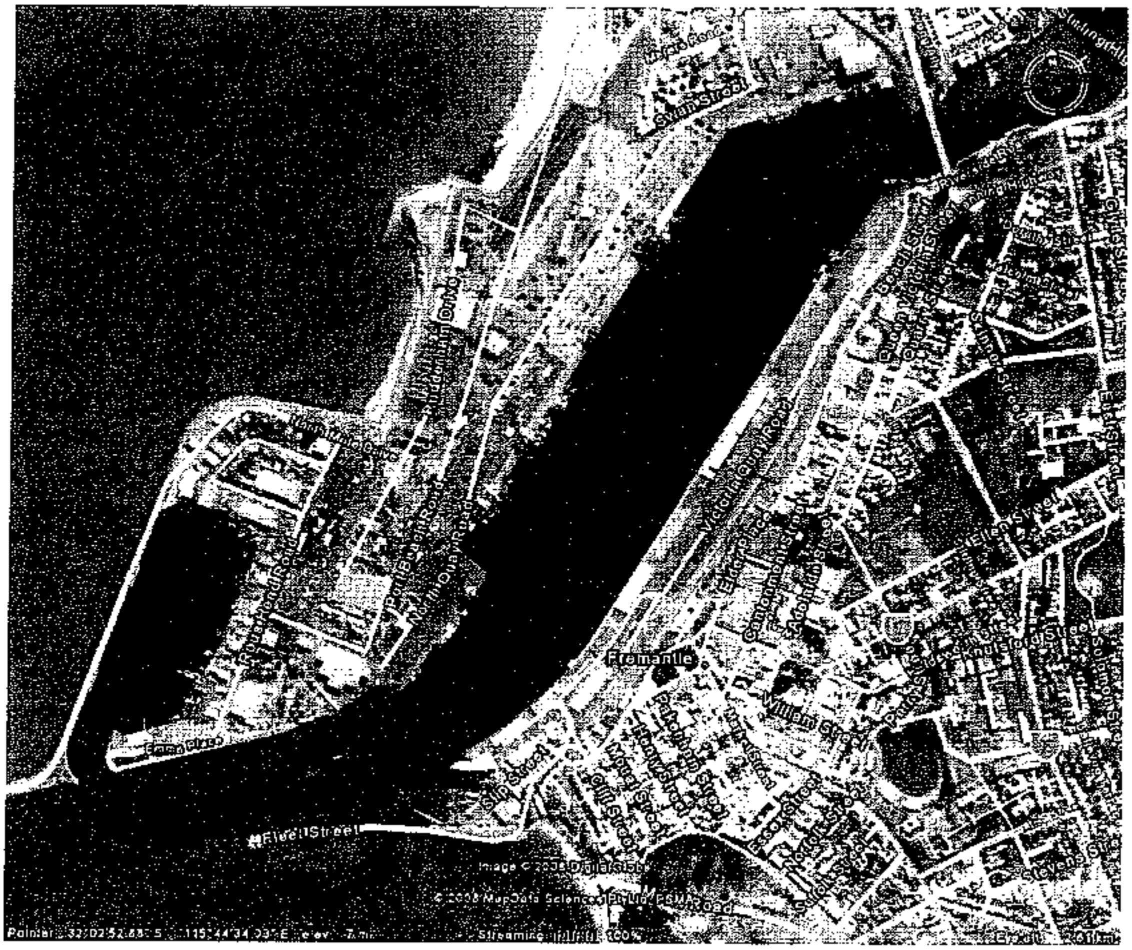
Hillarys Marina showing the development over the last 20 years - from google earth 2008



Hillarys Marina looking north showing the six lane launching ramp with one catwalk serving two ramps and the large vehicle/ trailer parking area at the north east corner of the harbour,



Hillarys Marina looking seawards with the launching ramps and parking area on the right.



Fremantle Inner Harbour 2007 google earth

33 Fremantle

Early History

The first ocean jetty was built in 1830 but deteriorated so badly that a second jetty was built in 1837 to replace it just below the Round House with access to Fremantle through the tunnel, which still exists today. In 1854 a South Jetty was built towards Owen Anchorage together with a North Jetty into the Swan River just above the rock bar.

It was not until 1872 that work commenced on the Long Jetty, which was progressively extended in 1886, 1888, 1891 and 1896 to a total length of 3,294 feet (1,004 metres), providing for 8 berths with a depth of water a low tide of 22 feet (7 metres). Following the completion of the inner harbour at Fremantle, the Long Jetty was no longer used for commercial shipping and converted for pleasure use and even had a hall built on it in 1907.

In 1921 due to the overall deterioration of the timbers and piles the jetty was demolished.

Work on the Fremantle inner harbour commenced on November 16th 1892 when Lady Robinson wife of the Governor Sir William Robinson tipped the first load of Rocky Bay stone to start the 2,934 feet long North Mole, which was completed in January 1895.

In May 1894 work commenced on the construction of the South Mole at Arthur Head, which was completed in August 1897.
Dredging of the harbour was carried out using a Priestman Grab, followed by the bucket dredge Parmelia and cutter suction dredge "Premier".

One of the most labour intensive phases of the work was the blasting of the rock bar at the harbour entrance, using up to 16o men operating hand drills and jumper bars and working from temporary trestles.

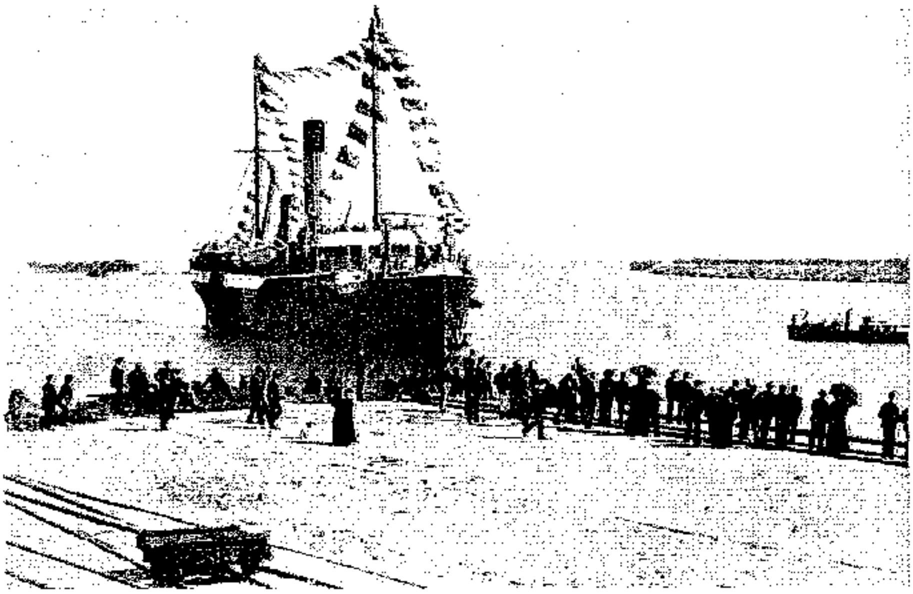
The land back berths (wharves) were constructed of timber halfcaps, corbels, beams, and decking on a jarrah pile sub-structure. Piles were spaced at 12 feet centres in each direction.

The South or Victoria Quay was 62 feet wide with the maximum halfcap length being about 40 feet with staggered splices. Rails were laid proud of the decking. The quay was constructed for a total length of 5,055 feet.

On the north side of the harbour 2,000 feet of quay was built. Because of the great rush of traffic to the Colony in the 1890s wharves were also built alongside the moles, 1,000 feet on the north side and. 300 feet on the south.

The jarrah piles, no doubt with a cast iron and steel shoe attached, were actually driven through the limestone of the moles.

On May 4th 1897 the first practical demonstration of the satisfactory progress of the works was given, when the S.S. *Sultan* of the Western Australian Steam Navigation Company arrived from Singapore. The vessel proudly entered the new harbour with flags and bunting flying and berthed at Victoria Quay.



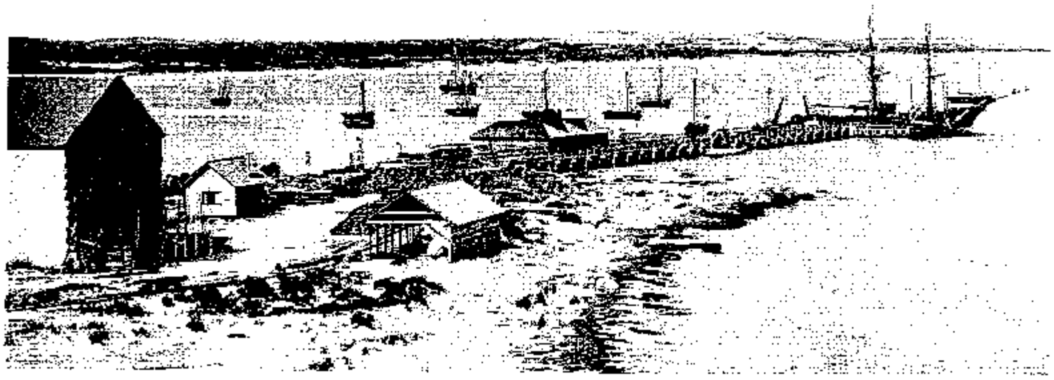
The SS Sultan entering Fremantle Harbour on 4th May 1897
acknowledgement - Western Gateway - John k Ewers 1948

Due to the severe teredo attack on the Fremantle wharves, a complete rebuilding of both Victoria Quay and the North Wharf had to be carried out over several years commencing in 1912 with the replacement piles being charred and tarred and partly encased in a concrete sleeve. This however did not prove to be entirely successful and between 1923 and 1943 all timber sheeting and timber piles were replaced with reinforced concrete.

A casting yard was set at the rear of the western end of Victoria Quay

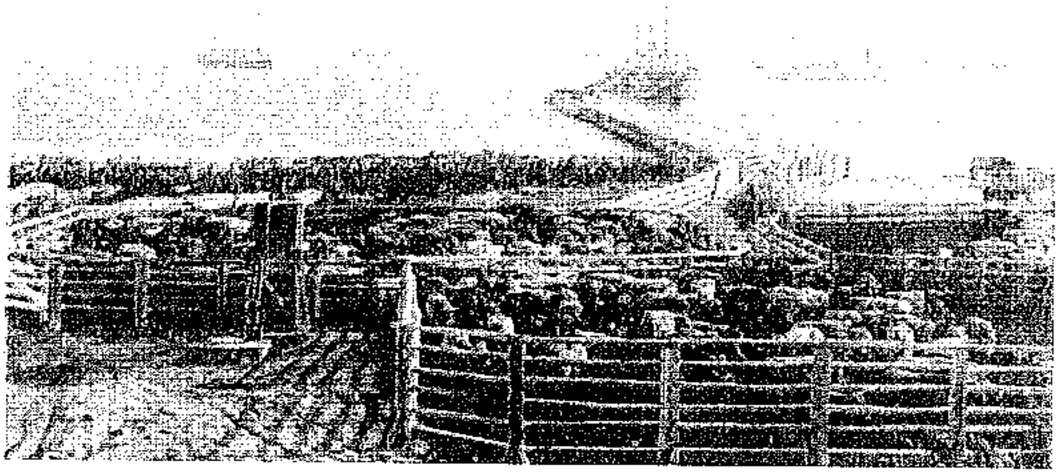
The concrete aggregates and cement were elevated by three separate conveyors to the top of the plant and gravitated through a hopper to the rotary concrete mixer, from where the designed concrete mix was discharged into the concrete pile forms via a rail mounted trolley traveling the length of the pile form

It is believed that this batching plant was one of the first set up in Western Australia for the precasting of concrete piles.



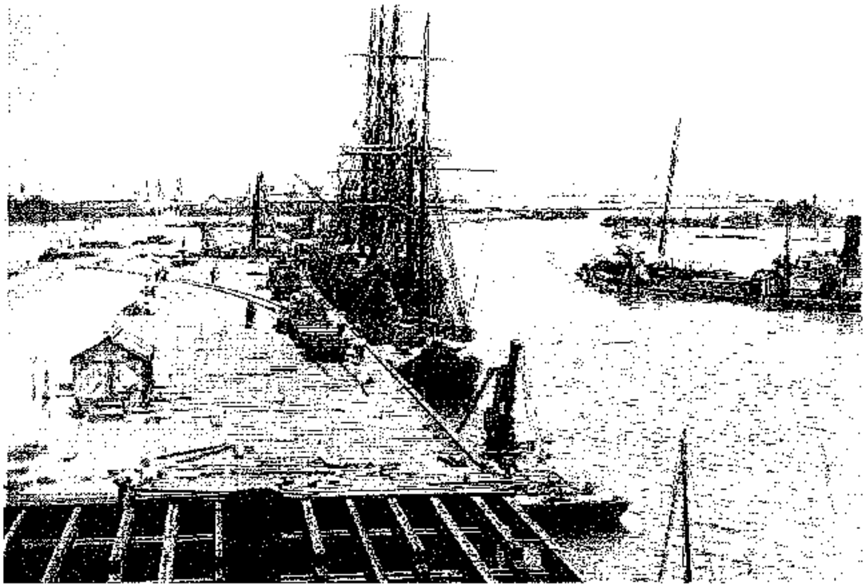
Fremantle South Jetty 1871. The building on the left is one of the Commissariat Stores. The tram line (railway) in the left foreground ran down Cliff Street to the North Jetty, located in the lower navigable part of the Swan River upstream of the bar and from which jetty stores were loaded onto river barges for Perth,

Acknowledgement Simon J Nevill – Perth and Fremantle Past and Present.

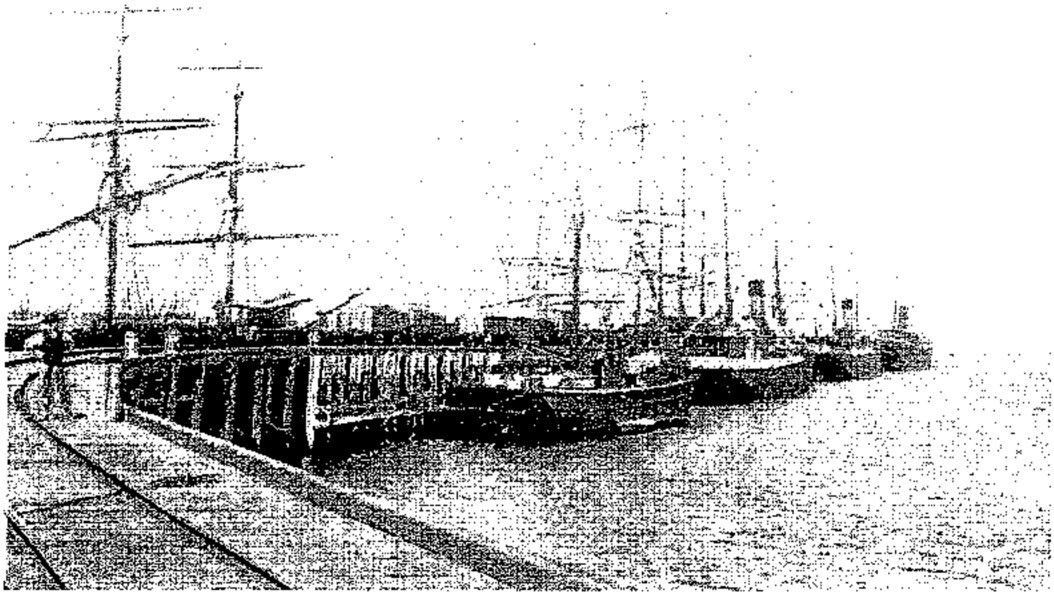


Robb's Jetty c. 1912 – It was considered more practical to load cattle in and out from a separate jetty away from Fremantle - hence the building of a separate jetty a few miles south of South Beach. Cattle came mainly from the Kimberley region.

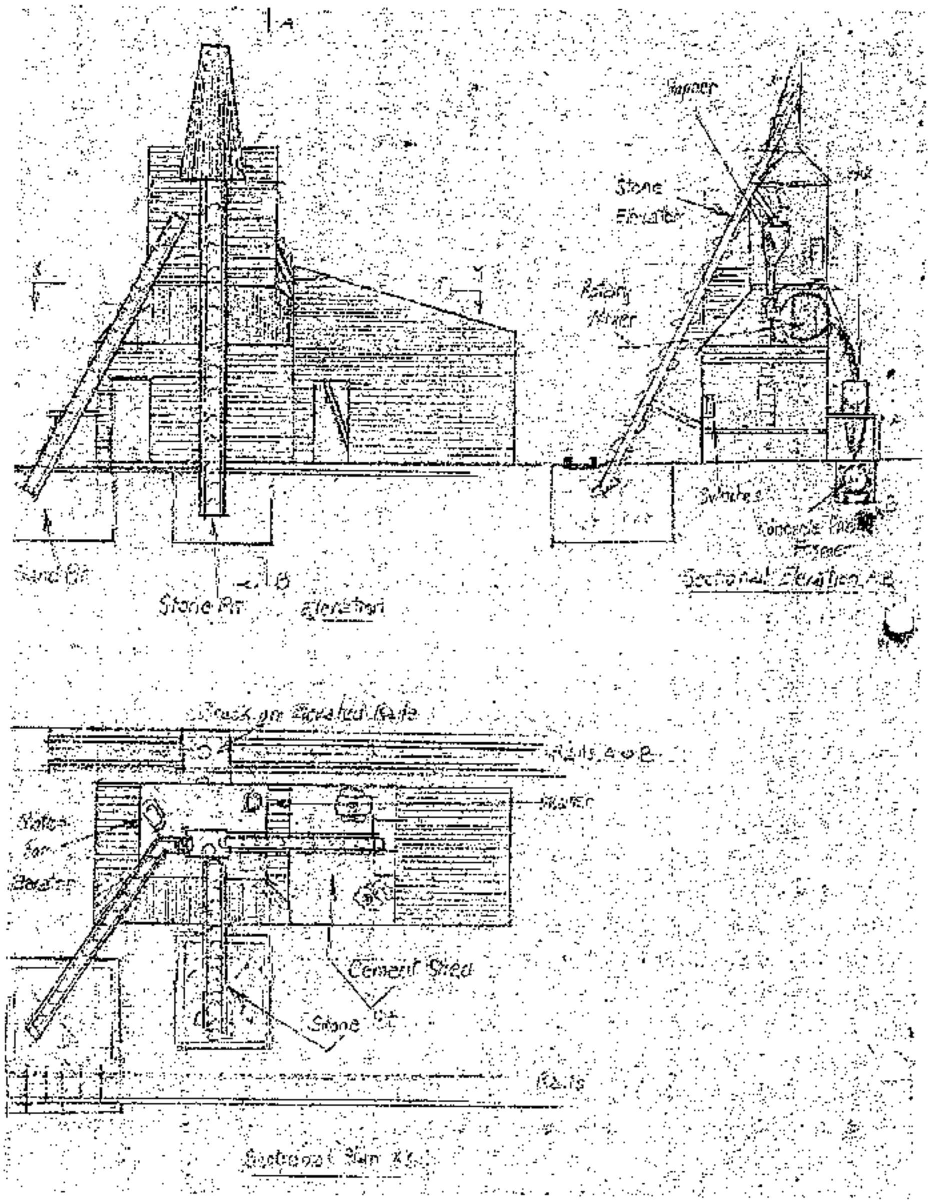
Acknowledgement Simon J Nevill – Perth and Fremantle Past and Present.



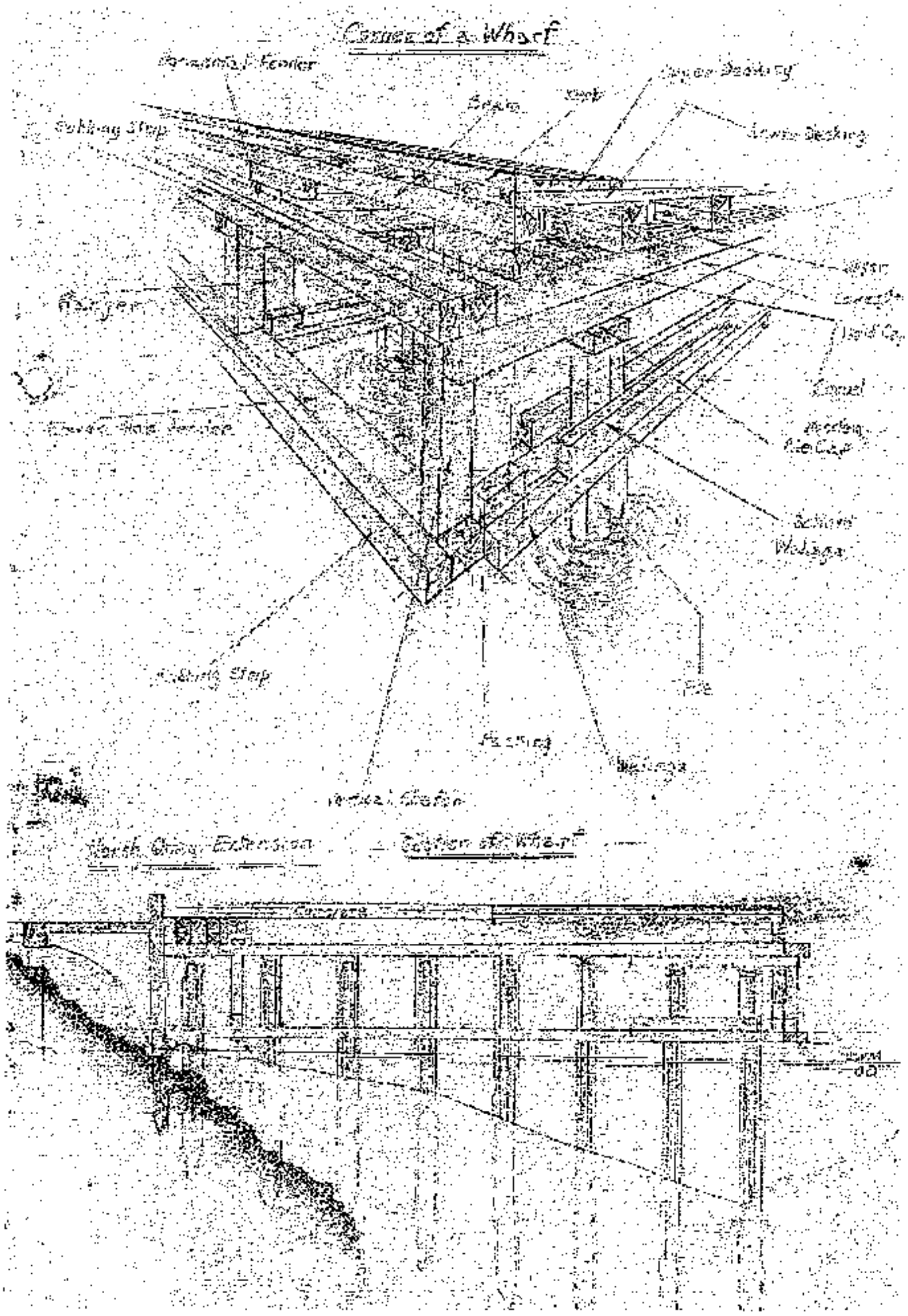
Building Victoria Quay 1897. . The small ship in the foreground is the Orpheus from Auckland. The suction dredge Premier is on the right, and beyond is the trestle set up for blasting the limestone bar from across the mouth of the Swan River. The Arthur Head 1879 lighthouse is on the extreme left. Teredo worms feasted on the jarrah wharves, and within ten years some parts of the quay had collapsed. The government was promoting the use of jarrah, and pressured the port to keep using it instead of concrete... In 1923 the wharves again had to be replaced, though that work was not finished until 1938 on the south quay and 1943 on the north.
Acknowledgement - Old Fremantle John Dowson



The "outer harbour" long jetty 1886 – acknowledgement History of Fremantle JK Hitchcock 1929



The reinforced concrete batching plant taken from a sketch by the writer when he was a student engineer at Fremantle Harbour Works in the 1944/45 university vacation,



Diagrammatic view of the wharf cross sections on the Fremantle North Quay extension in 1944/45 drawn by the writer when he was a student engineer at Fremantle Harbour Works in the 1944/45 university vacation,

During World War II various works associated with the war effort were carried out. A boom defence system was installed at Fremantle incorporating a wire rope fence and a central gate across the harbour entrance. The gate was operated by a winch located on the North Mole.

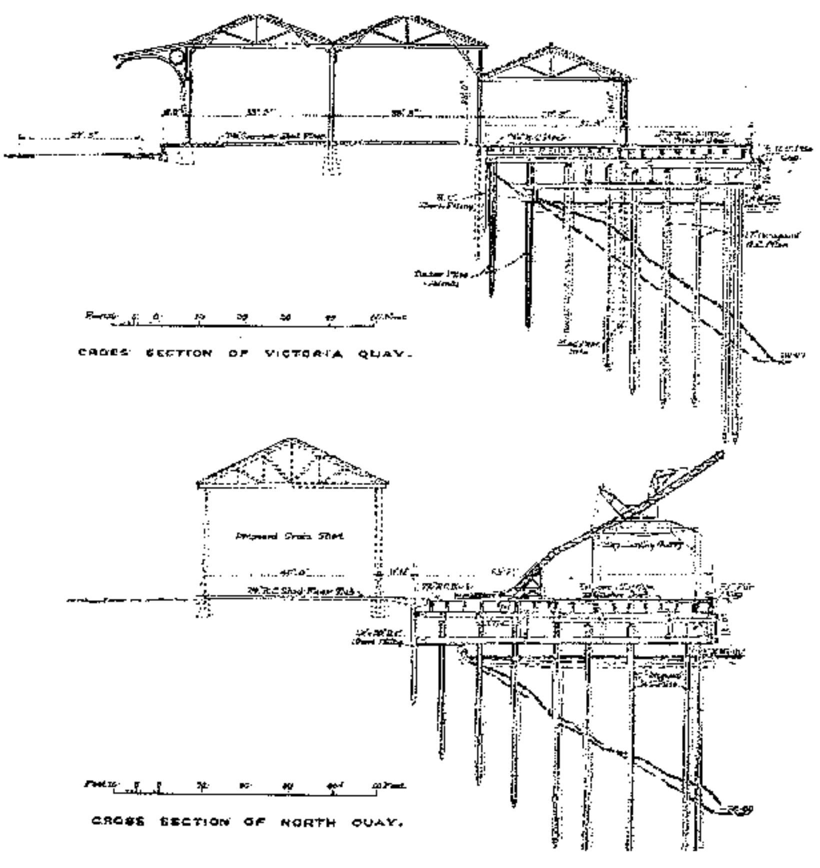
Harbour Development 1950s

Between 1954 and 1958 further works carried out a Fremantle included the construction of No 10 at the eastern end of the North Quay and the provision of small boat facilities at the eastern end of the harbour.

The features of No 10 berth were different to any wharf structures previously constructed in Western Australia in that it did away with the longitudinal and transverse structural members, replacing them with a heavy reinforced concrete slab supported on reinforced concrete piles. Subsequent wharves of this design were improved by having the concrete piles replaced with tubular steel piles, as for example the No 5 berth at Geraldton, the No 2 Inner Harbour berth at Bunbury, No 1 and 2 berths at Esperance and the No 1 berth at Port Hedland.

The Resident Engineer on this project was JD Gillespie and the Engineer, Harbours and Rivers was NJ Henry.

After 1958, works within the port were taken over by the Port Authority's own engineering organisation.



Cross Sections of Victoria Quay and North Quay Reconstruction

Fremantle Outer Harbour 2007 *google earth*

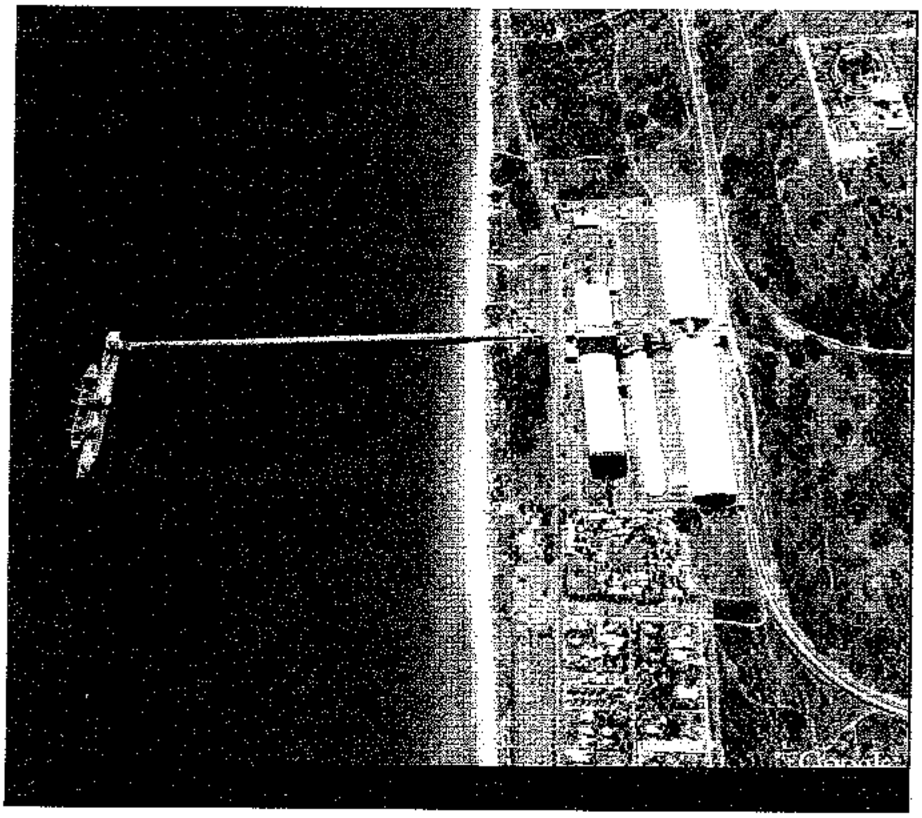
Fremantle Outer Harbour Development 1950s

With the exception of Rockingham, Careening Bay, Owen Anchorage and Jervoise Bay, the development of Cockburn Sound as an outer harbour to the Port of Fremantle itself is a modern phenomenon which began in the 1950s.

First was the opening of an oil refinery and its port facilities in 1955, a steel rolling mill in the following year, an alumina refinery in 1964, a blast furnace and fertilizer plant in 196?\, power station 1970, nickel refinery, 1973 and bulk grain terminal in 1976.

As a result of these and other developments, the sound has become a major port serving many industries and the Kwinana Industrial area generally.

Acknowledgement - Port Related Structures on the Coast of Western Australia Denis Cumming



Co –Operative Bulk Handing jetty and bulk loading installation in the outer harbour. 2008 ***google earth***

34 Fremantle Harbour Works

Fremantle Harbour Works was the "back bone: of the Harbour and Rivers day labour organisation and supplied or supplemented materials, plant, labour, supervision and expertise for marine works carried out over the whole State.

Under its clerical arm it also maintained a complete costing section for all marine works and also ran a plant and stores suspense account,

It was responsible through the State Government Stores Department for the supply, quality control and forwarding materials as and when required to the regional centres.

This also included the prefabrication, treatment and forwarding of structural components to field jobs

It also served in conjunction with the Mechanical and Plant Engineers Branch of the Public Works Department as the supply for all marine and other plant required on day labour works.

Apart from this overall State function it had its own metropolitan and near metropolitan duties to carry out in the construction and maintenance of all Swan and Canning River government and local government jetties, wharves, launching ramps, slipways, foreshore walling, navigation aids and dredging berths, basins and channels.

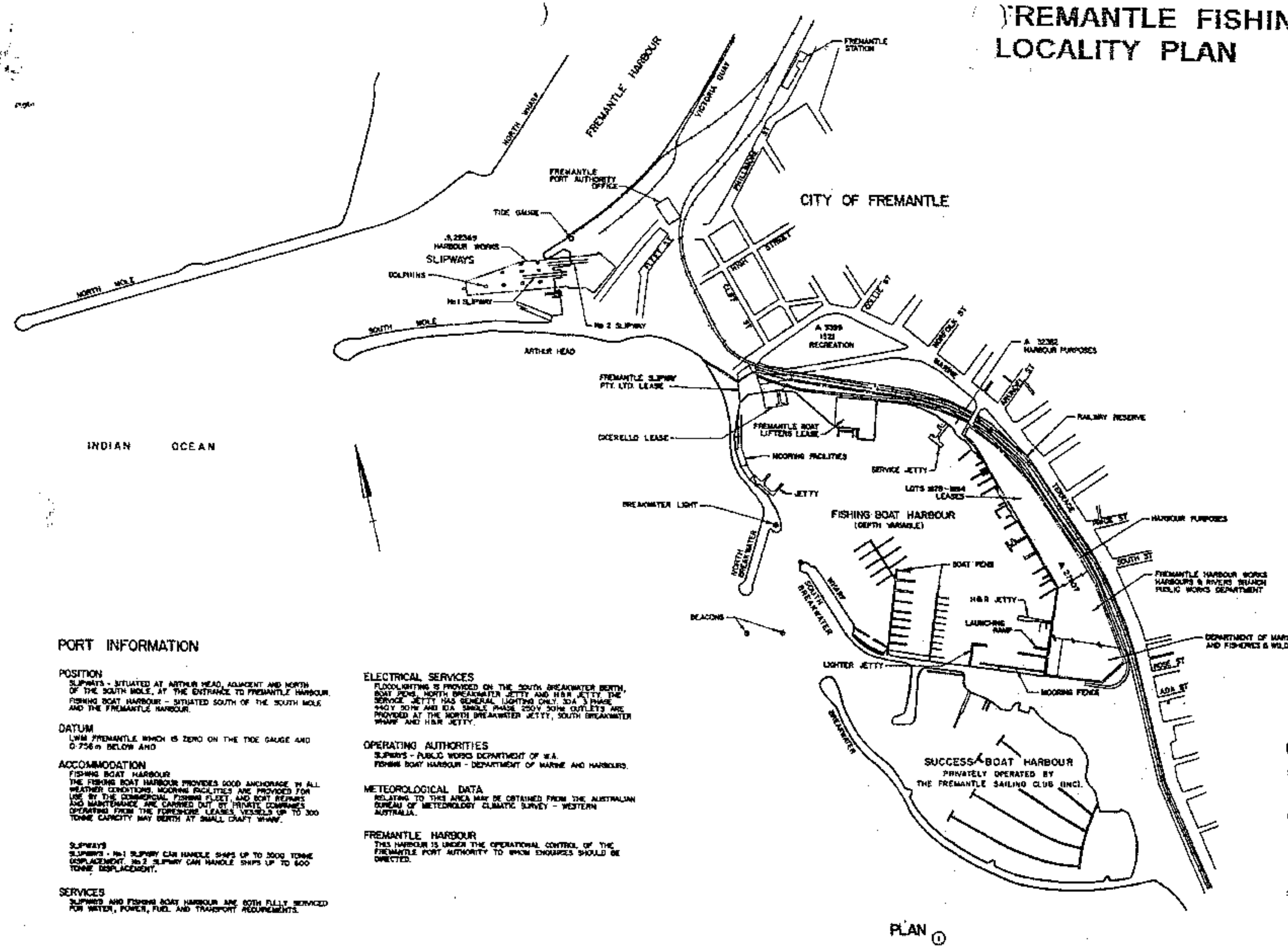
Through its oyganisation the Fremantle Harbour Works was responsible for

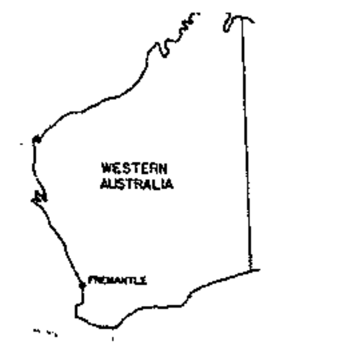
> Supplementing the marine construction teams throughout the whole State
> the storing, fabricating and treating material prior to forwarding to the field,
> the modifying, maintaining and storing plant
> the providing of expertise in pile driving. operating floating plant, steel fabrication, surface treatment
> providing materials in conjunction with Government Stores

Fremantle Small Boat Fishing and Recreational Harbours Marine Terrace, Fremantle 2007

google earth

FREMANTLE FISHING BOAT HARBOUR LOCALITY PLAN





PLAN ①

PORT INFORMATION

POSITION
SLIPWAYS - SITUATED AT ARTHUR HEAD, ADJACENT AND NORTH OF THE SOUTH MOLE, AT THE ENTRANCE TO FREMANTLE HARBOUR.
FISHING BOAT HARBOUR - SITUATED SOUTH OF THE SOUTH MOLE AND THE FREMANTLE HARBOUR.

DATUM
LWM FREMANTLE WHICH IS ZERO ON THE TIDE GAUGE AND 0·756 m BELOW AHD

ACCOMMODATION
FISHING BOAT HARBOUR
THE FISHING BOAT HARBOUR PROVIDES GOOD ANCHORAGE IN ALL WEATHER CONDITIONS. MOORING FACILITIES ARE PROVIDED FOR USE BY THE COMMERCIAL FISHING FLEET, AND BOAT REPAIRS AND MAINTENANCE ARE CARRIED OUT BY PRIVATE COMPANIES OPERATING FROM THE FORESHORE LEASES. VESSELS UP TO 300 TONNE CAPACITY MAY BERTH AT SMALL CRAFT WHARF.

SLIPWAYS
SLIPWAYS - No 1 SLIPWAY CAN HANDLE SHIPS UP TO 3000 TONNE DISPLACEMENT. No 2 SLIPWAY CAN HANDLE SHIPS UP TO 600 TONNE DISPLACEMENT.

SERVICES
SLIPWAYS AND FISHING BOAT HARBOUR ARE BOTH FULLY SERVICED FOR WATER, POWER, FUEL AND TRANSPORT REQUIREMENTS.

ELECTRICAL SERVICES
FLOODLIGHTING IS PROVIDED ON THE SOUTH BREAKWATER BERTH, BOAT PENS, NORTH BREAKWATER JETTY AND H&R JETTY. THE SERVICE JETTY HAS GENERAL LIGHTING ONLY. 30A 3 PHASE 440V 50Hz AND 10A SINGLE PHASE 250V 50Hz OUTLETS ARE PROVIDED AT THE NORTH BREAKWATER JETTY, SOUTH BREAKWATER WHARF AND H&R JETTY.

OPERATING AUTHORITIES
SLIPWAYS - PUBLIC WORKS DEPARTMENT OF W.A.
FISHING BOAT HARBOUR - DEPARTMENT OF MARINE AND HARBOURS.

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY CLIMATIC SURVEY - WESTERN AUSTRALIA.

FREMANTLE HARBOUR
THIS HARBOUR IS UNDER THE OPERATIONAL CONTROL OF THE FREMANTLE PORT AUTHORITY TO WHOM ENQUIRIES SHOULD BE DIRECTED.

REFERENCE PLANS

	PWD., WA
SLIPWAY:	
No 1 - 3000t SLIPWAY	29243
CRADLE	40953
DOLPHINS	46855
No 2 - 600t SLIPWAY & CRADLE	33620
FISHING BOAT HARBOUR:	
HARBOUR	36010 SH.2
LEASES	36010 SH.1, 29673
BOAT PENS	43647
SERVICE JETTY	45420
H&R JETTY	44928
FISHERIES & WILDLIFE JETTY	50693
BREAKWATER	19977
JETTY (NORTH BREAKWATER)	32879
SOUNDINGS (1977 CHANGES)	50327
SUCCESS BOAT HARBOUR	51586

100 50 0 100 200 300
SCALE OF METRES ①
(1:10000)

GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES.

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ZONE	DATE	REVISION	DTN	APPD
SURVEY BOOKS			FILE No	
			PW 2248/65	

REVISED TO PER. IN 1985

SCALES AS SHOWN
MICROFILMED
DATUM
AS SHOWN

DESIGN CALC. — BOOK
CHECKED — BOOK
DRAWN PJS — CHECKED CS/JHS
TRACED — CHECKED
SUPERVISING DESIGN ENGINEER, H&R
SUBMITTED — DATE 19 12 17
Z. DESIGN
APPROVED — DATE 24 11 74
CH. HARB.

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
FREMANTLE – FISHING BOAT HARBOUR & SLIPWAYS
LOCALITY PLAN AND SERVICES DATA

DS PWD WA 53923 – 8 – 1
REV

35 Fremantle Small Boat Harbours

Early History

In 1920 a rock breakwater 800 feet (203 metres) in length was built running in a southerly direction just south of the abutment of the old long jetty to form a protective water area for fishing boats. Refer to the location on 1947 street plan at page 57.

Harbour Development 1960s

Major improvements were carried out to the fishing boat harbour between 1960 and 1970.giving added protection to the harbour by the construction of the southern breakwater in 1961/62.
The department owned dredge Stirling removed 750,000 cubic yards of spoil from within the harbour which was pumped to reclamation on the harbour periphery, with the reclaimed land being developed for port related activities. A steel sheet pile land backed wharf was built in 1963/64, followed by a 600 feet extension of the southern breakwater in 1967/68 together with the provision of the first stage of mooring pens in the now protective water area, together with an extension of the northern breakwater and additional pens on the south side of the harbour.

In 1970/71 the present capacity of approximately 300 fishing boats in the Fremantle Fishing Boat Harbour was increased by the provision of another 70 pens and the replacement of an existing public jetty commenced. A 286 feet length timber pile / concrete deck was completed in the Fishing Boat Harbour to service the Harbours and Rivers branch depot.

In 1972/73 a new public Jetty was constructed in the Fremantle Fishing Boat Harbour and the old concrete Jetty demolished. And the construction of further pens and a small jetty for the Department of Fisheries and Fauna was completed.

During the 1977 to 1980 period the construction of breakwaters for Fremantle Sailing Club was carried out by others and a new jetty for the Department of Fisheries was completed.

In the early 1980s An 85 metre length of mooring catwalk with 33 pens was completed in the southern part of the Fremantle Fishing Boat Harbour and a 60 metre long land backed berth at Mews Road and a 84 metre length land backed berth in the northern section of the harbour were constructed. Provision of facilities for the holding of the Americas Cup commenced with the construction of breakwaters and land reclamation. Ultimately there would be 3 enclosed boat harbours used for accommodating syndicates competing in the Race. They were Success Harbour controlled by the Fremantle Sailing Club, the Fremantle Fishing Boat Harbour and the newly constructed Challenger Harbour located in an area between the fishing boat harbour and the south mole of Fremantle

Harbour. Both of these harbours came under the control of the Department of Marine and Harbours, previously the Harbour and Light Department.

In 1980/81 arrangements were made for the transfer of two luffing gantry cranes from the Fremantle Port Authority to the South Slipway to replace the two old existing cranes.

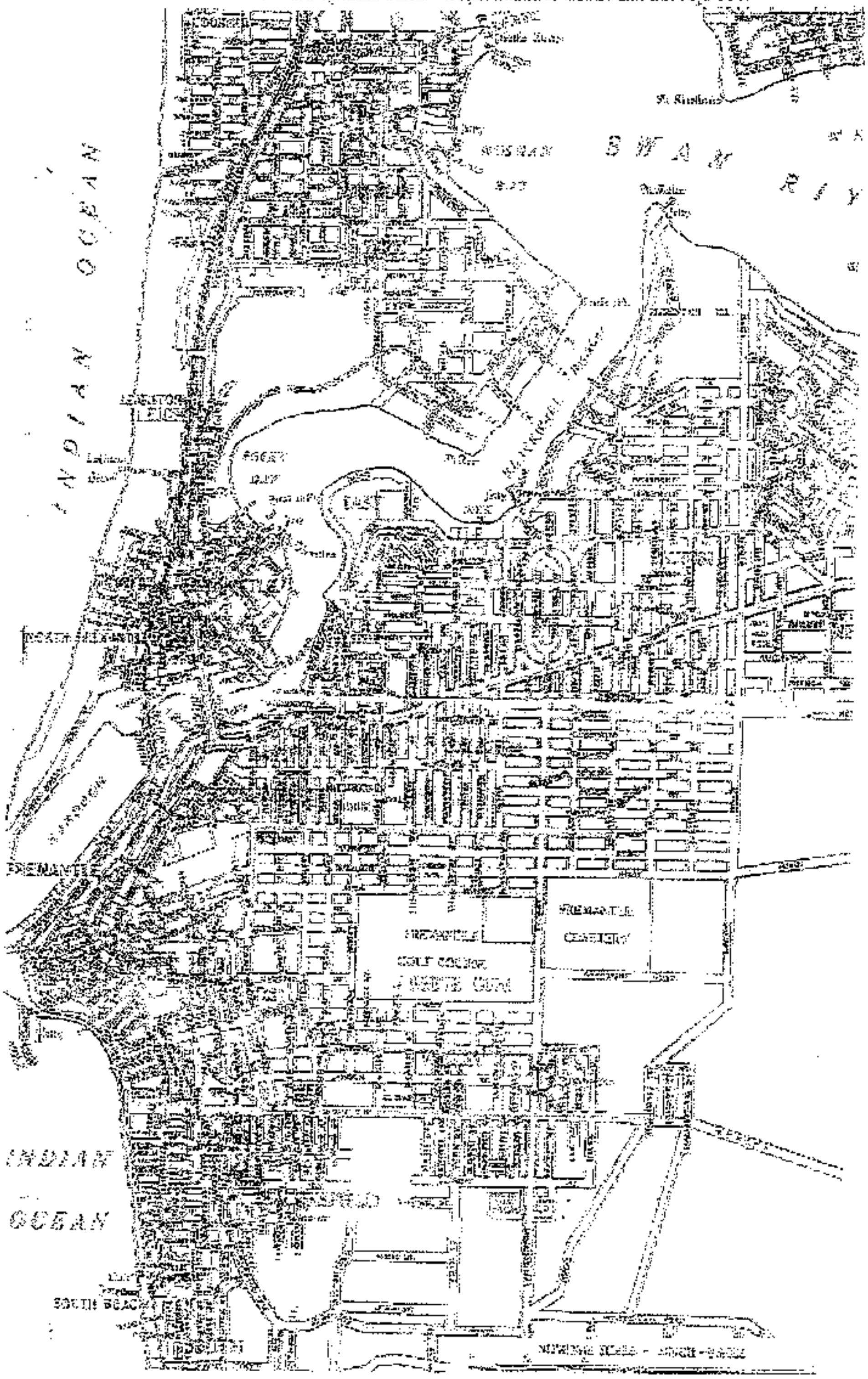
In 1984.85 implementing the planning for the America's Cup facilities proceeded with the construction of the two breakwaters and associated fill to provide areas for the Royal Perth Yacht Club and eight syndicate sites in the outer Challenger Northern Boat Harbour.

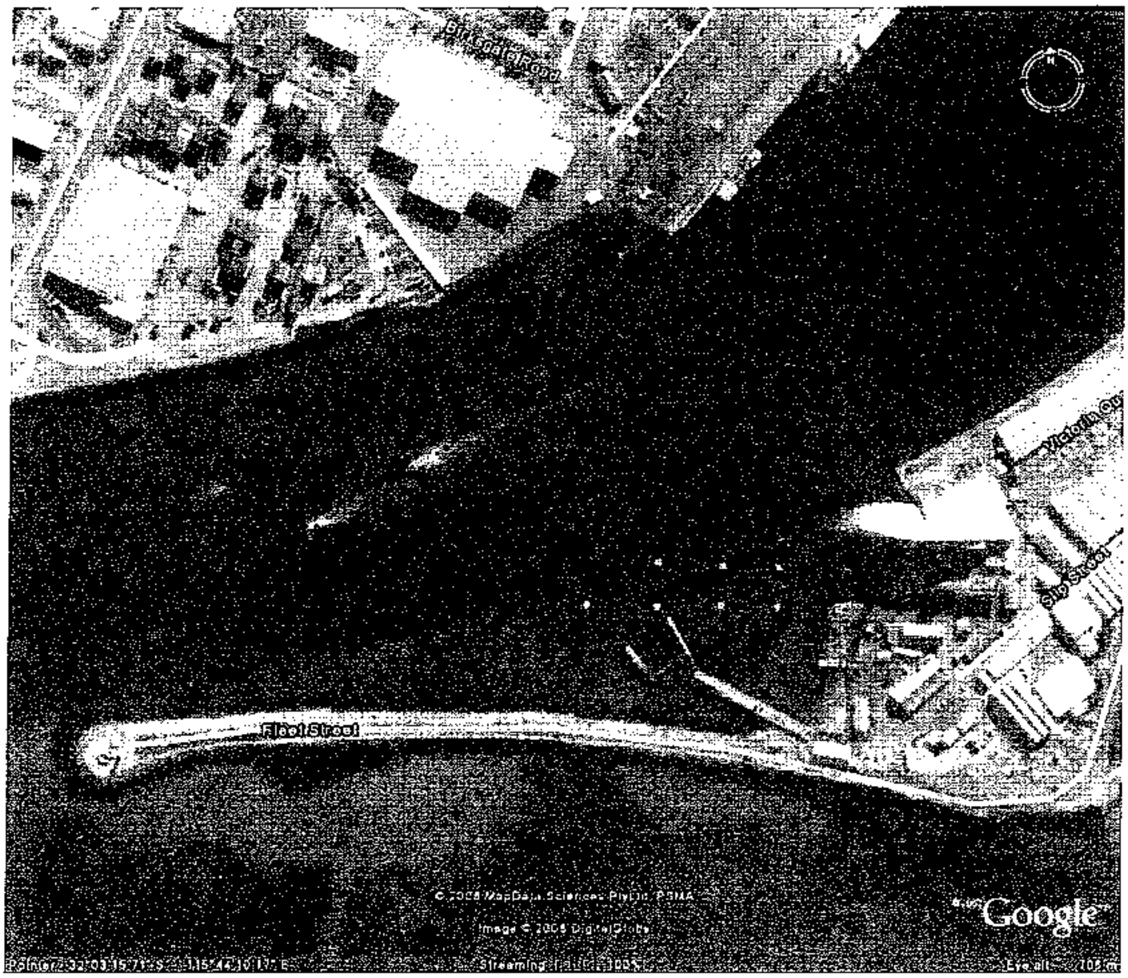
A hydrographic survey was undertaken and a chart prepared for specific use with the America's Cup.

Fremantle Small Boat Harbours – Challenger Harbour to the north, Fremantle Fishing Boat Harbour and the northern end of Fremantle Sailing Club's Success Harbour,

LOWER SWAN ESTUARY 1947

Reference — The Metropolitan Area — Department of Lands and Surveys 1947





Fremantle South Slipways 2007 google earth

36 Fremantle Slipways

Early History

The first attempt to provide a reasonable slipping facility at Fremantle was the construction in 1900 of a 650 tons slipway at Rous Head on the north side of the harbour.
In 1910 work commenced on the construction of a dry dock also at Rous Head. Due to unsatisfactory ground conditions the work was abandoned in June 1912.
In 1922 a site was selected at Arthur Head for the building of a new hull for the dredge Parmelia. The work was undertaken by the State Implement and Engineering Works (later State Engineering Works), with the hull being launched in December 1926 and the total refit being completed in the 1928/29 years.

The slipway on the north side of the harbour at Rous Head had long been regarded as inadequate for the port. Originally it had a capacity of 650 tons displacement and was later modified to accommodate vessels up to 1000 tons. General deterioration caused this figure to be reduced to 850 tons by 1938 when proposals were made for the construction of a new and larger slipway.

Owing to the restricted area of the harbour and proposals for future extensions, the possible sites were limited. It was eventually located at Arthur Head between the South Mole and the western end of Victoria Quay near where the new hull for the *Parmelia* had been built and launched in the 1 920s. The site was the best available but was not quite free from rough weather conditions and a cross ebb during winter floods. The vessel capacity of the slipway was fixed at 2000 tons and authority to proceed with construction was given in September 1940.
The design was based on a slip way built in Mombasa, Kenya. It originally incorporated a telescopic cradle which closed up to its shortest length on reaching the stop at the end of the ways. This reduced the length of ways required. A telescopic cradle when extended had a considerable gap between the aft keel block of one cradle section and the forward block of the next section. Also the grade of the keel blocks followed the grade of the ways which had been fixed at 1 in 20. After construction had been commenced, Fremantle became a highly important wartime base for submarines of the U.S. and British navies and it was essential that the new slipway should be capable of handling them. The thin shells of the submarines required support on the cradle at close centres and a much flatter cradle line than the 1 in 20 proposed. The telescopic cradle was changed to provide a fixed cradle with timber cribbing to provide either a In 50 or a 1 in 96 grade:

Arthur Head Slipway Upgrading 1950

The south slipway at Arthur's Head on the southern side of the entrance to Fremantle Harbour had been designed to cater for a vessel of 2000 tons slipping displacement. In the middle 1950s problems began to occur with haulage due to a variety of reasons: vessels started to exceed the design load; bearings were getting worn; fuel oil on the water surface of the harbour was dissolving the grease in the open bearings of the cradle wheels; and it was difficult to lubricate the bearings in the lower end of the cradle at times of high tide. A design was prepared for a sealed bearing with pressure lubrication to replace the old half-shell open bearings.

The improvements in the bearings, however, were unable to keep pace with the tonnage of the vessels requiring slipping, particularly those of the State Shipping Service. Another problem was that vessels were frequently presented for slipping at a displacement in excess of the stated amount, usually due to a failure to empty oil and water tanks sufficiently.

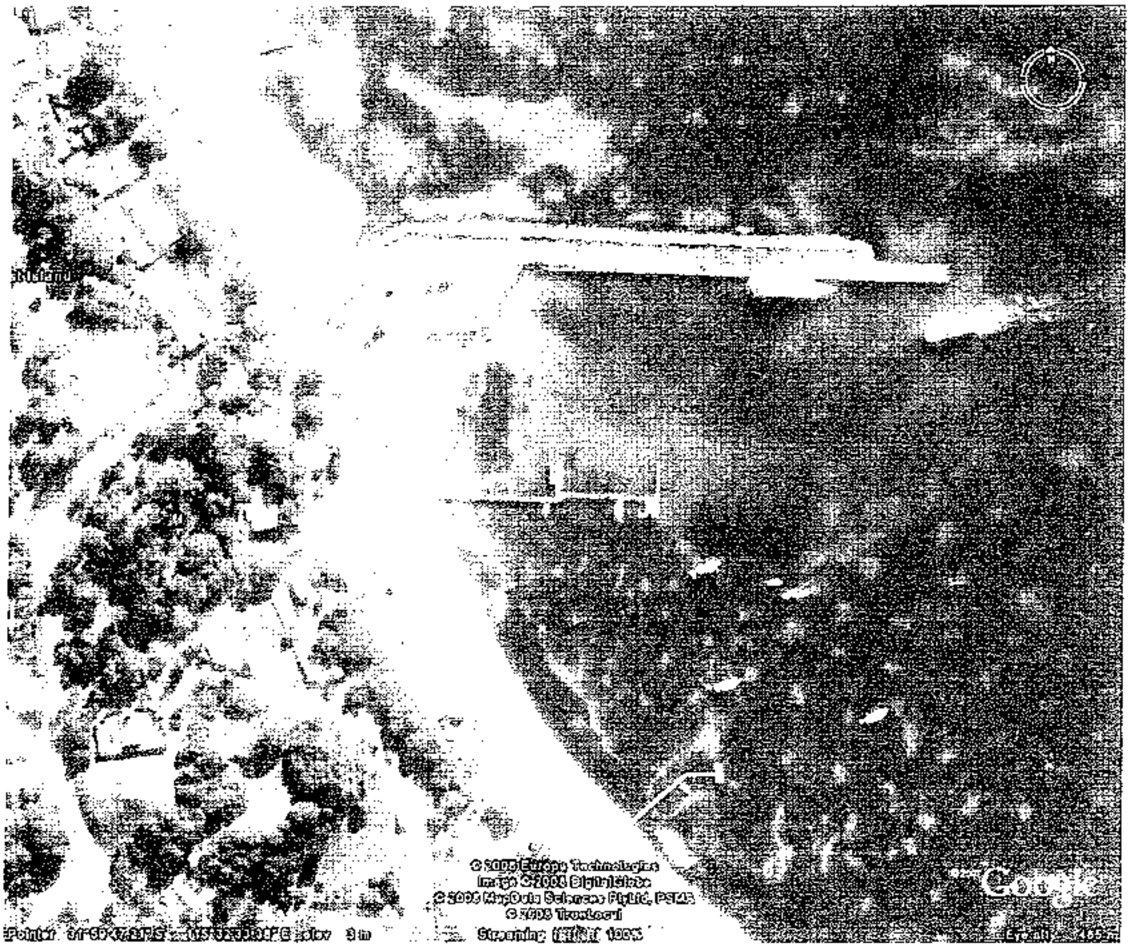
Eventually New bearings were fitted throughout and had a beneficial result but only enough to keep pace with the increase in tonnage of the vessels of the State Shipping Service.

In 1958-59 the slipway was fitted with a changed pulley system which allowed the last and heaviest portion of the haul to be carried out on a four part rope haul in place of two. These improvements allowed the maximum slipping displacement to be increased to 2750 tons. Eventually even these improvements were insufficient for the newest state ship, the *Kangaroo,* and an entirely new cradle was built. By this time the slipway was carrying loads over 50% greater than its original design capacity.

A second slipway was constructed at Arthur Head to cater for ships up to 600 tons and the first vessel was successfully slipped on May 13th 1959. Some of the mechanical parts of the winch from the Rous Head slipway built about 50 years earlier were incorporated into the new winch. A new type of scaffolding mast was also introduced.

Both slipways were closed in 1983.

Acknowledgement Building a State – JSH LePage



Rottnest Island Ferry Termial Thompson Bay 2007

google earth

37 Rottnest Island

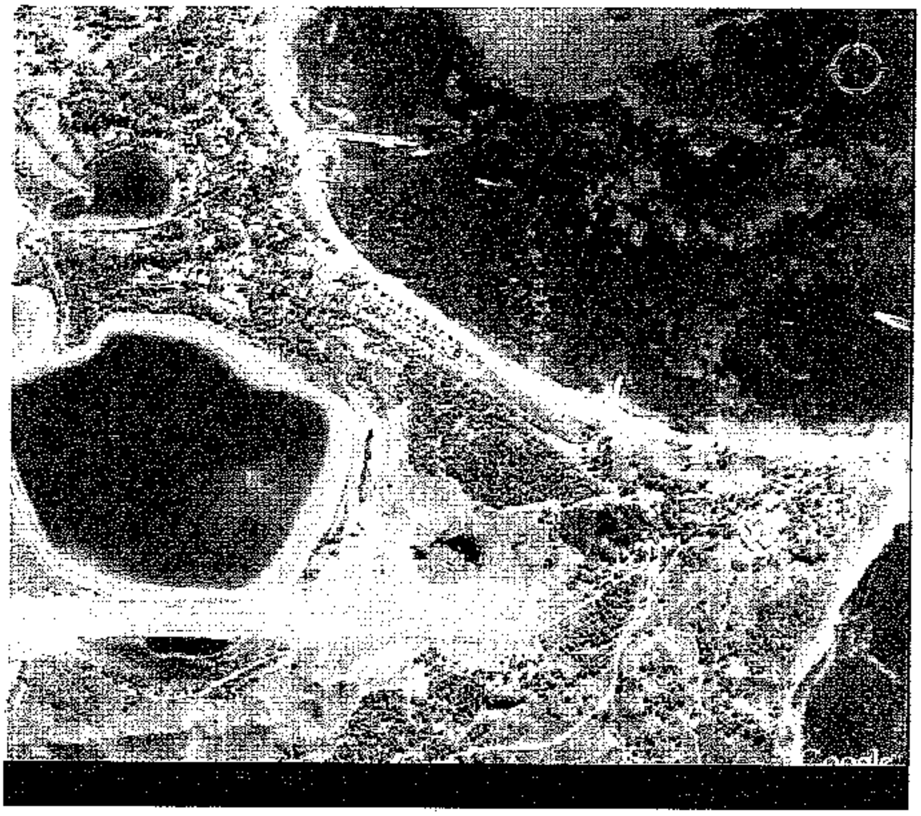
Early History

In 1907 a jetty was built at the southern end of Thomsom Bay which comprised of a 170 feet (51 metres) long rock causeway with a 104 feet (32 metres) long timber head. (This became known as the Army Jetty)

Harbour Development 1960s

In the 1960s extensive work was carried out at Rottnest in providing a new Ferry Terminal and ancillaries in Thomson Bay including the dredging of the entrance channel and wharf turning basin.

In 1980/81 the fender system of the wharf was upgraded to take vessels of 400 tonnes displacement.



Thomson Bay, Rottnest showing the "Army Jetty: at the southern end of the bay and the Ferry Terminal to the north.

For several years in the late 1960s and the early 1970s fresh water was

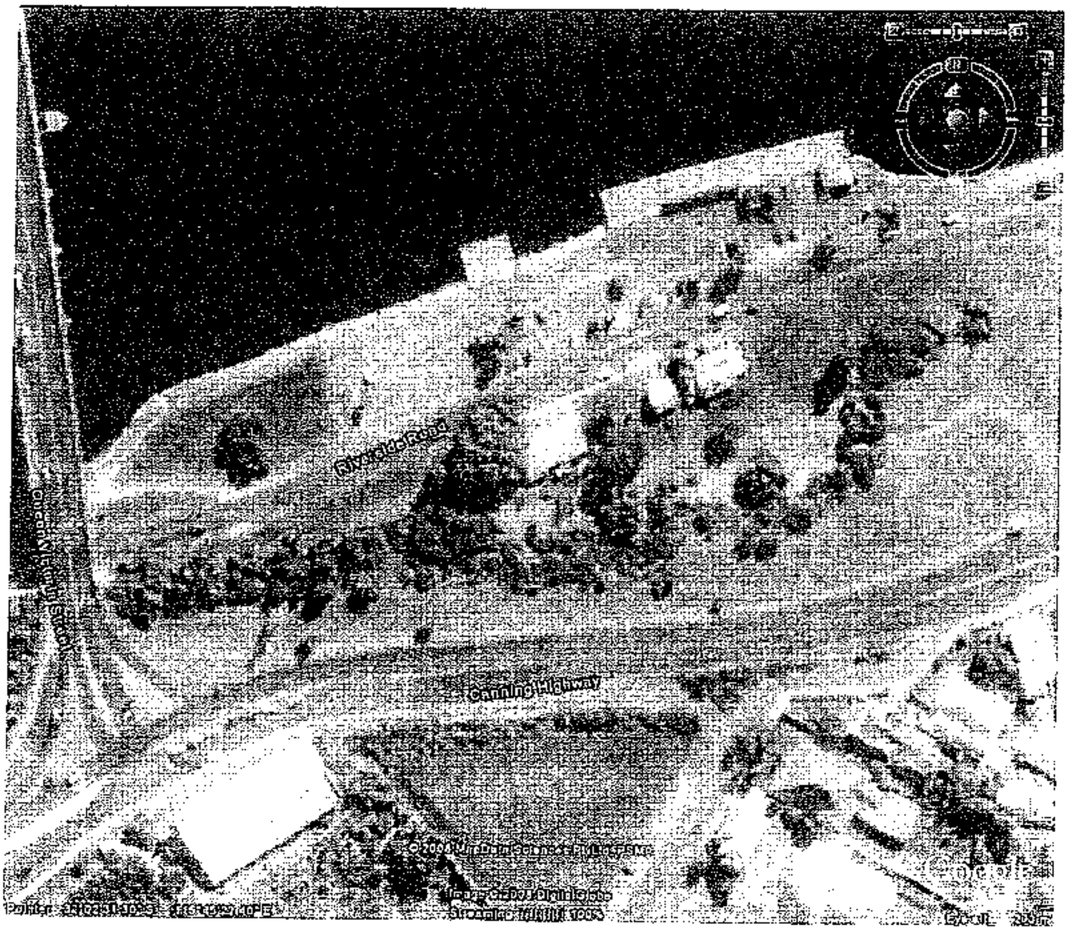
carted from Fremantle to Rottnest using the survey vessel "Gunga Din" and departmental barges towed by workboats.

In 1982/83 various sites were examined for a possible boat harbour, including Porpoise Bay and Thompson Bay. Surveys of the various areas were completed.

New navigation aids were positioned at Thomson Bay, Geordie Bay and Longreach Bay.

A navigation chart of the surrounding waters was published.

Rottnst Island 2008



Swan River Fremantle Ferry Terminal 2007

google earth

Swan River – Barrack, Mends and Coode Street Jetties 2007 *google earth*

38 Swan River Berths and Jetties

Early History

One of the first wharf structures provided in the Swan River to serve Perth was a stone wall wharf built in 1830 at the foot of Pier Street. This structure proved to be most inadequate but it was not until 1841 that the first substantial jetty was built at the foot of William Street.

A second jetty was built in 1842 at the foot of Mills Street.

In 1850 a timber jetty was built at Anglesea Point south of the Swan River entrance between Bathers Beach and South Bay near the foot of the current Fremantle Fishing Boat Harbour northern breakwater, This jetty had a 484 feet (145 metres) neck and a 92 feet (280 metre) long by 54 feet (165 metres) wide head into 9 feet (2.7 metres) of water. The jetty known as the South Jetty served Fremantle until the early 1870s.

In 1855 a second jetty, known as the North Jetty was built inside the mouth of the Swan River at the foot of Cliff Street. Imported goods destined for Perth had to be offloaded at the South Jetty and transported the short distance by land across to the North jetty.

On 1890 the first hydrographic survey was carried out of the Swan and Canning Rivers. The result of this survey identified a channel of 13 feet below low water between North Fremantle and the Narrows.

Between 1893 and 1896 the dredge *Black Swan carried* out dredging in the two rivers, one of the first projects being the dredging of the 7,250 feet long channel in the Canning River near Salter's Point. This channel was dredged to 4 feet below low water and was confined within two wattle staked walls on either side of the channel.

Another earlier river project was the dredging of the Claisbrook Channel in 1895 to shorten the time taken by barges traveling from Guilford to Perth.

One of the first river reclamation works was the elevating of the foreshore between Barrack and William Street

In 1897 the dredge *Black Swan* dredged a four feet depth channel from Barrack Street to Mends Street in South Perth, which was widened to 120 feet and deepened to five feet in 1900. A channel was also dredged from Barrack Street to Coode Street

To cope with the Fremantle to Perth river traffic a seven feet deep channel was dredged from the Narrows to the Swan River Shipping Company's wharf between William Street and Mill Street.

During this period Jetties were built at Point Walter, Mill Point, Mends Street and Claremont. The Claremont Jetty, which was built off from Pensioners Terrace, now Victoria Avenue had a 226 feet long embankment with a 237 feet long neck and a 65 feet by 27 feet head

\In 1907 a sea jetty for recreational purposes was built at Cottesloe. The jetty had 380 feet long by 19 feet wide neck terminating with a 42 feet by 20 feet head. It was demolished in 1952/

A 500 feet ling by 23 feet wide wharf structure was built on the foreshore at the foot of Barrack Street in 1907, together with four jetty piers built out from the wharf. About the same time jetties were built at East Street Maylands and Coode Street South Perth.

The locations of some of the early jetty type structures between Fremantle and Perth, some of which were still standing in 1947 and others which have been demolished or replaced are shown at pages 115 and 116/.

Going upstream from Fremantle on the north bank

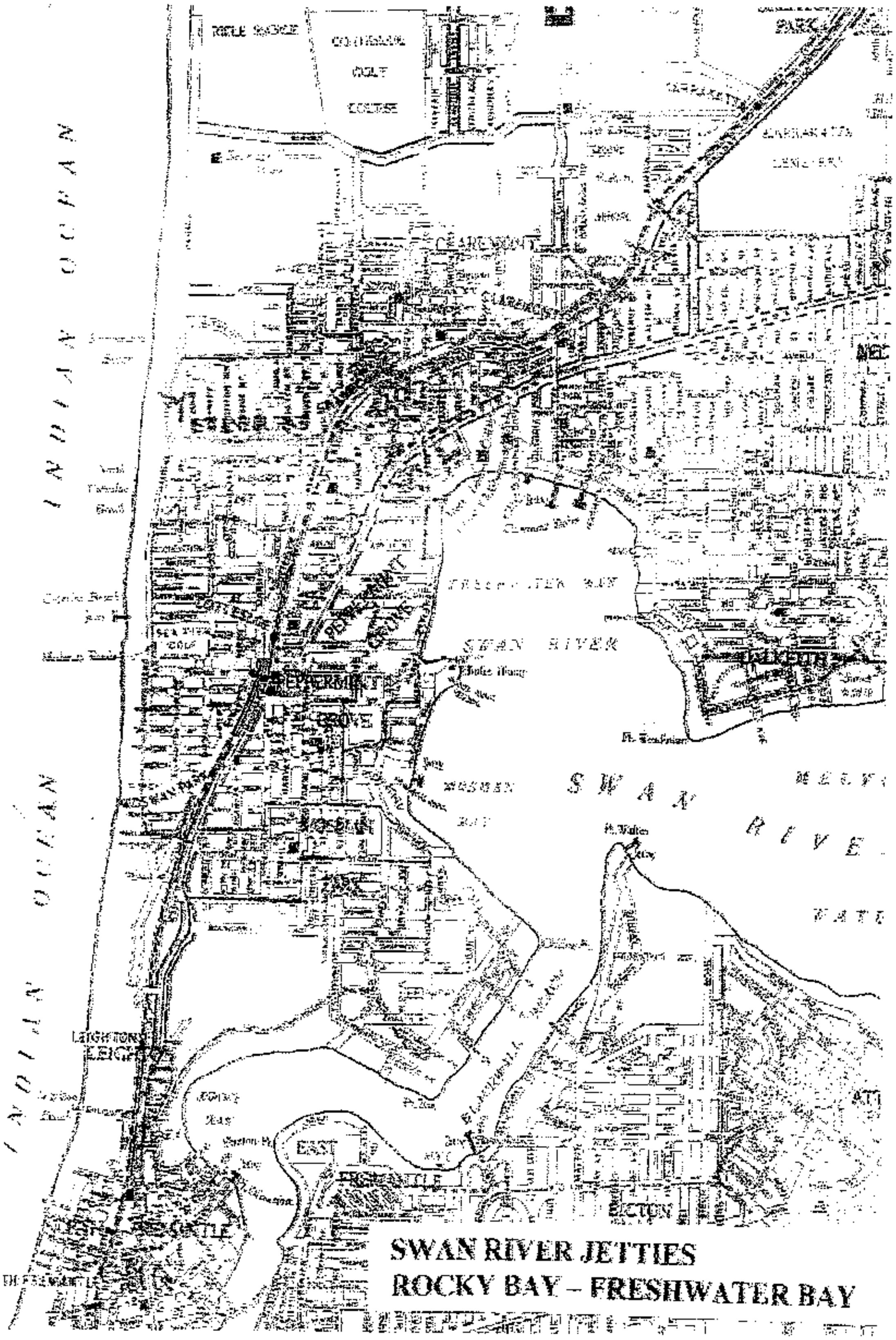
- The"Dillinghams" jetty North Fremantle
- Mosman Park Jetty
- Keanes Point Jetty
- Claremont Jetty
- Claremont Baths
- Nedlands Baths
- University Boat Club Jetty
- Crawley Baths
- Point Lewis Jetty – Narrows
- Barrack Street Jetties

Going downstream of the Causeway south bank

- Coode Street Jetty
- Mends Street Jetty
- Mill Point Jetty - Narrows
- Como Jetty
- Canning Bridge (Raffles Landing)
- Applecross Jetty
- Point Walter Jetty
- Bicton Jetty (Bicton Baths)
- Beach Street Jetty at traffic bridge
- Beach Street Ferry Terminal

Structures upstream from the Causeway north bank

- East Street Jetty



SWAN RIVER JETTIES
ROCKY BAY – FRESHWATER BAY

SWAN RIVER JETTIES
MELVILLE WATER - PERTH WATER

Development 1970s

The ferry jetties at the foot of Barrack Street which had been constructed in 1907 and given a face lift on more than one occasion over the years, finally reached the end of their economic life in the 1970s.
A programme of progressive replacement commenced with No5 jetty in 1973-74 following the completion of a new jetty on the east side of the Union Jack Square for the Harbour and Light Department and the Police Department. The new No5 jetty included the use of pre-cast concrete sections, supported on 55feet long treated timber piles, was completed in 1975. Then followed Nos. 1 and 2 jetties followed by No4 and finally No3 jetty which was completed in early 1979. These jetties had a concrete deck supported on 30 feet long tubular steel piles.

All the new jetties had a vacuum sewerage disposal system to service all the vessels using the jetty complex.

Prior to the construction of these jetties the basin area was dredged using the dredge "Stirling" followed by the dredging of the channel from Barrack Street to Mend Street in South Perth.

A new replacement jetty with a concrete deck supported on 92 feet long steel piles was constructed at Mend Street in the late 1970s. followed by the Department's 8 inch cutter suction dredge PW 8 dredging the basin at the Mend Street jetty and a channel from Mend Street to the Coode Street jetty - and the timber foreshore wall between Ellam and Coode Streets in South Perth. was replaced

Buildings on the jetties were designed by the Architectural Division

The fender system on the berth at the East Fremantle Ferry Terminal, East Street was strengthened to take the larger Rottnest Island ferries. A new slipway was constructed at the Harbours and Rivers depot at Ellam Street at Victoria Park and the construction of a new public launching ramp commenced at Point Walter.

In 1972 the 8" dredge PW 8 dredged an Olympic standard rowing course upstream from Canning bridge in the Canning River and carried out dredging at the Matilda Bay jetties, the Qantus ramp and Point Walter.

Between 1976 and 1979 extensive dredging was carried out by the Department's 8" cutter suction dredge PW 8 in the Swan River and at Fremantle. This included the dredging of the basin at Mends Street jetty, the dredging of Coode Street channel, the dredging at Barrack Street jetties, Mill Street drain, Point Dundas, Pickering Park and Preston Point and dredging works at Fremantle Fishing Boat Harbour and the Fremantle South Slip.

A new launching ramp was completed at Point Walter and work proceeded on a launching ramp complex at Preston Point, East Fremantle.

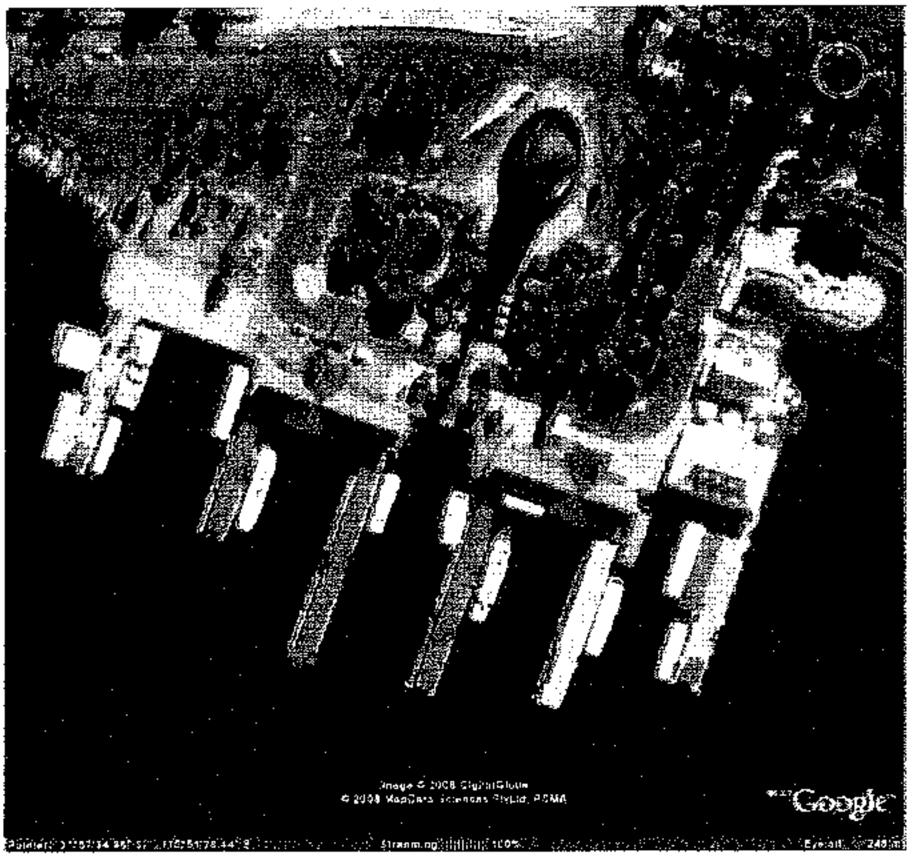
In 1979 a jetty was constructed at Tranby House for the National Trust and a heavy lift Jetty was completed at East Street at East Fremantle.

Beach rehabilitation was carried out at Cottesloe beach and beach replenishment and dredging was carried out at Pickering Park, Bassendean

In 1980 a replacement jetty was constructed at Keane; s Point.

In 1982 the construction of the replacement jetty at Como was completed and repairs to the Nedlands river foreshore wall were undertaken

In 1982 investigations were carried out on the upgrading of the Canning River Rowing Course.



Barrack Street Jetties 2008 ***google earth***

39 Jervoise Bay

Early History

On 14 December 1829, Thomas Peel first landed colonists in Jervoise Bay at a-place soon to become known as Clarence. It was later the site of a gazetted townsite.

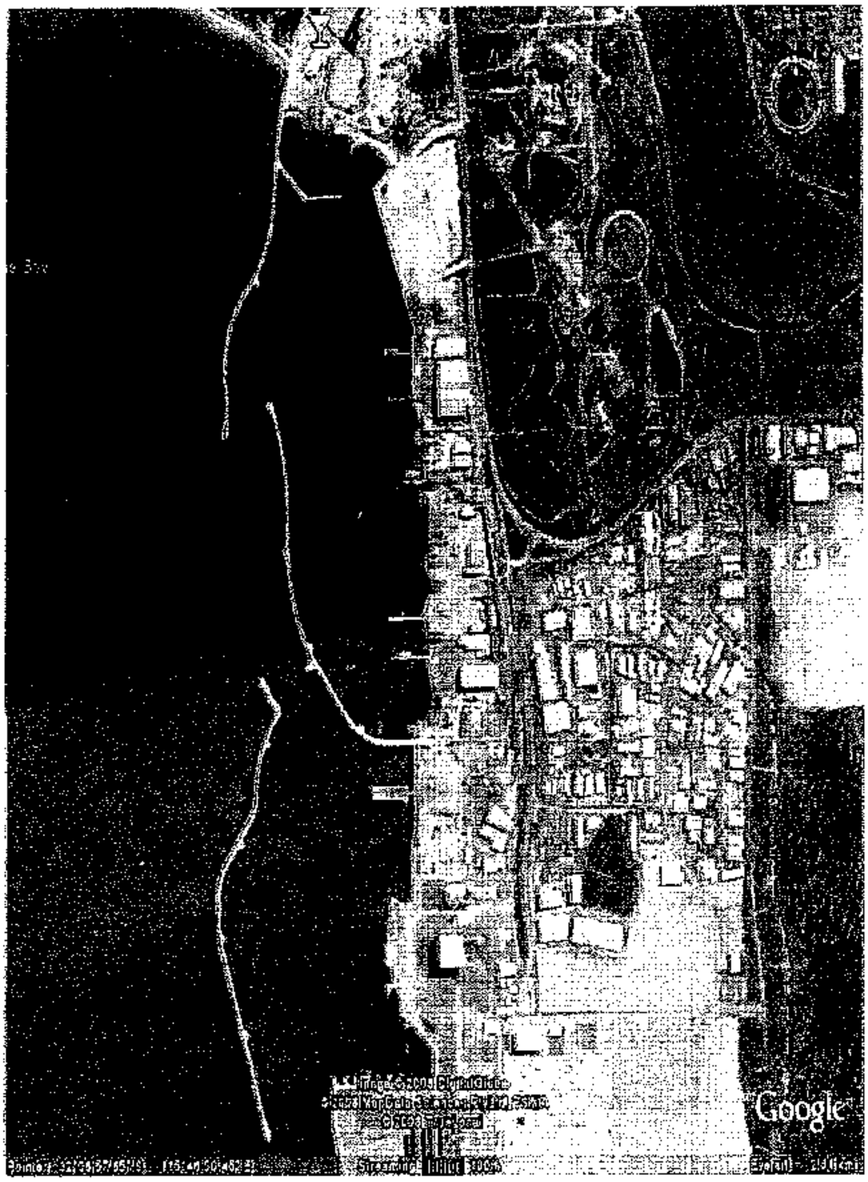
His three ships, the *Gilmore, Hooghly* and the *Rockingham* landed settlers and stores onto a wind-swept, desolate place in stages, the final group landing from the *Rockingham* during a mid-winter gale that almost resulted in the loss of the ship.

The disenchanted settlers drifted away and the proposed town site did not eventuate. The port of Rockingham thrived and Jervoise Bay had no role until towards the end of the nineteenth century, when it was used as a dumping ground for redundant ships. In the arms race up to world War I, it was proposed that a naval base, to be named the Henderson Naval Base, would be built in the Bay. Though preliminary work started in 1912, the project was shelved during the war and the concept was later totally abandoned under the terms of the 1921 Washington Agreement.

Development 1980s

In 1983/84 a precast concrete slab steel pile type skirt breakwater was built at the northern end of Jervoise Bay to provide a protective water area for recreational craft anchoring in Jervoise Bay, but still allowing for water circulation to meet environmental requirements. This structure, being partly of an experimental type eventually failed as a result of unpredicted sea action and was eventually replaced with a conventional rock fill breakwater

Since that time the whole area has been subject to extensive breakwater construction to provide protective water areas for boat building and allied industries.



The extent of the current marine development at Jervoise Bay showing the extensive breakwaters which have been built since the initial precast concrete slab steel pile type skirt breakwater was built at the northern end of the bay. some 24 years ago. This type of breakwater was built to satisfy the requirements of the then strong environmental lobby which had great concern for the pollution of Cockburn Sound in general and Jervoise Bay in particular.

40 Garden Island

Early History

Little appears in the records relative to the use of this natural harbour and repair facility. The earliest known usage was for careening or the hoving down of vessels onto their sides to enable them to be cleaned of marine growth. HMS *Success* and the *Rockingham* are two well known vessels repaired in the Bay soon after European settlement in 1829. Many other instances followed, such as the American whaling ship *Iris* of 271 tons which was hove down for repairs in the Bay in 1856 after being grounded at Port Gregory. Henry Yelverton repaired the brig *Champion* of 225 tons in the Bay in 1857-8, and then employed it in the timber trade to Adelaide until 1861.

The Bay was used as a mooring for coal hulks, or floating wharehouses used for storing coal and sometimes other materials. The Adelaide Steamship Company established the coaling hulk *Kebroyd* of 363 gross tons in 1888 (wrecked 1889), *Harrison* of 384 tons in 1883, the *Redemptora* in 1892, the *Egmont* of 419 tons in 1900, the *Sesa* of 1332 g. tons in 1904, and the *Maranda* 1465 gross tons in 1915. Other hulks include the *Ellen* of 243 tons (1883-1890), *Herschel* of 814 tons (1893-1908) and the *Tamerfane 01'795* g.tons. The coal was bought into the bay by steam and sailing colliers such as the colliers SS *Colac* of 1479 tons and SS *Barrier* of 2036 tons which unloaded coal in 1892. It was an on-going process that served to alleviate the problems caused when steamers need to replenish their coal bunkers. It continued until the demise of steamships themselves and their replacement by oil powered vessels. The hulk *Sesa* was established in 1904 and was finally scuttled off Rottnest in 1928, and the hulk *Tamerlane* was scuttled in 1926 for example.

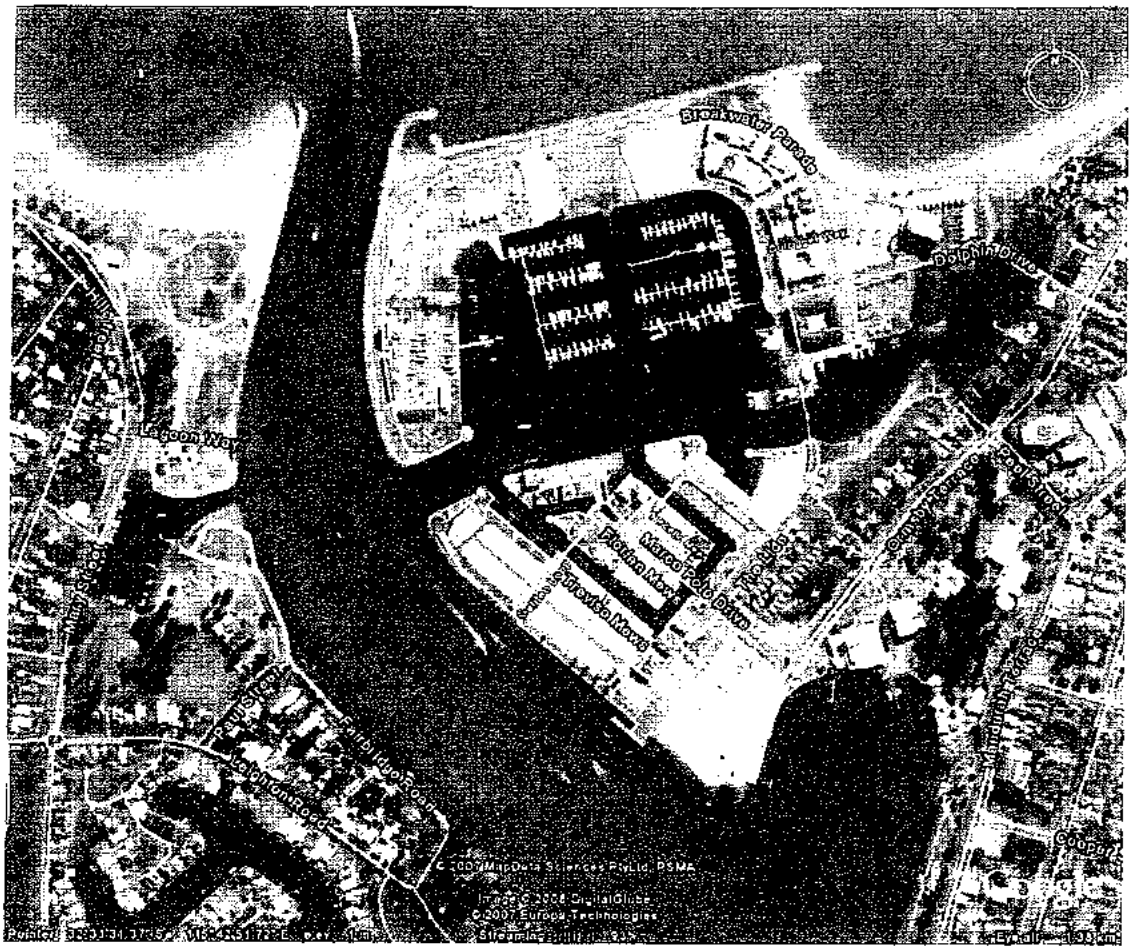
Nothing apart from the wrecks of the coal hulk, the ex-American whaler *Day Dawn* and the powder hulk, the ex sea-going brig, *Daro* remain as a reminder of these events. They are protected under the terms of the 1976 Historic Shipwrecks Act.

Acknowledgement - Port Related Structures on the Coast of Western Australia Denis Cumming

During World War II various works associated with the war effort were carried out, with jetties being built at Careening and Sulphur Bays on Garden Island, Palm Beach, and also for 'Fairmile' launches in Fremantle Harbour. A further defensive structure linked Point Peron and Garden Island.

41 Rockinghan

Rockingham Townsite was opened for selection in 1847 and the first jetty was built in 1870 for the export of timber from Jarrahdale. A second jetty was built in 1882. The port was described in 1923 as having two jetties about 3 miles east of John Point and connected by tramway to the Jarrahdale Timber Mills 26 miles away.



Mandurah Small Boat Facilities 2007 google earth

42 Mandurah

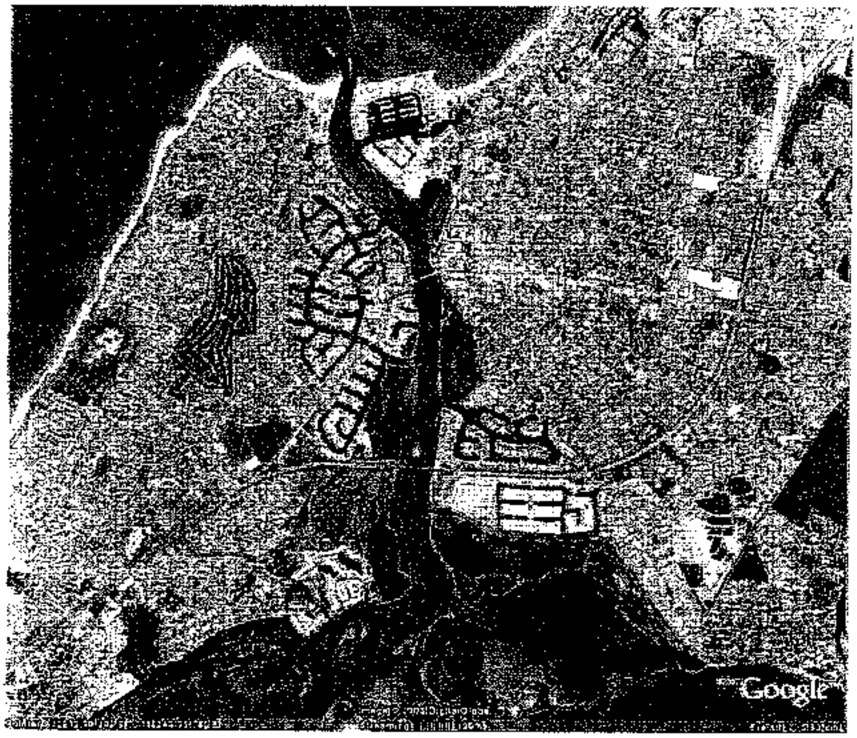
Between 1950 and 1980 extensive work to combat coastal erosion and siltation problems at the ocean entrance to Peel Inlet was carried out involving the building of two training walls (breakwaters) at the entrance to Peel Inlet together with coastal Groynes at Aileen Street, Henson Street, Wade Street and Orion Road.

In 1967 and 1968 the department's 8" cutter suction dredge PW 8 carried channel dredging at the entrance together with the dredging of the channels in the Serpentine and Murray Rivers and in Sticks channel in Peel Inlet.

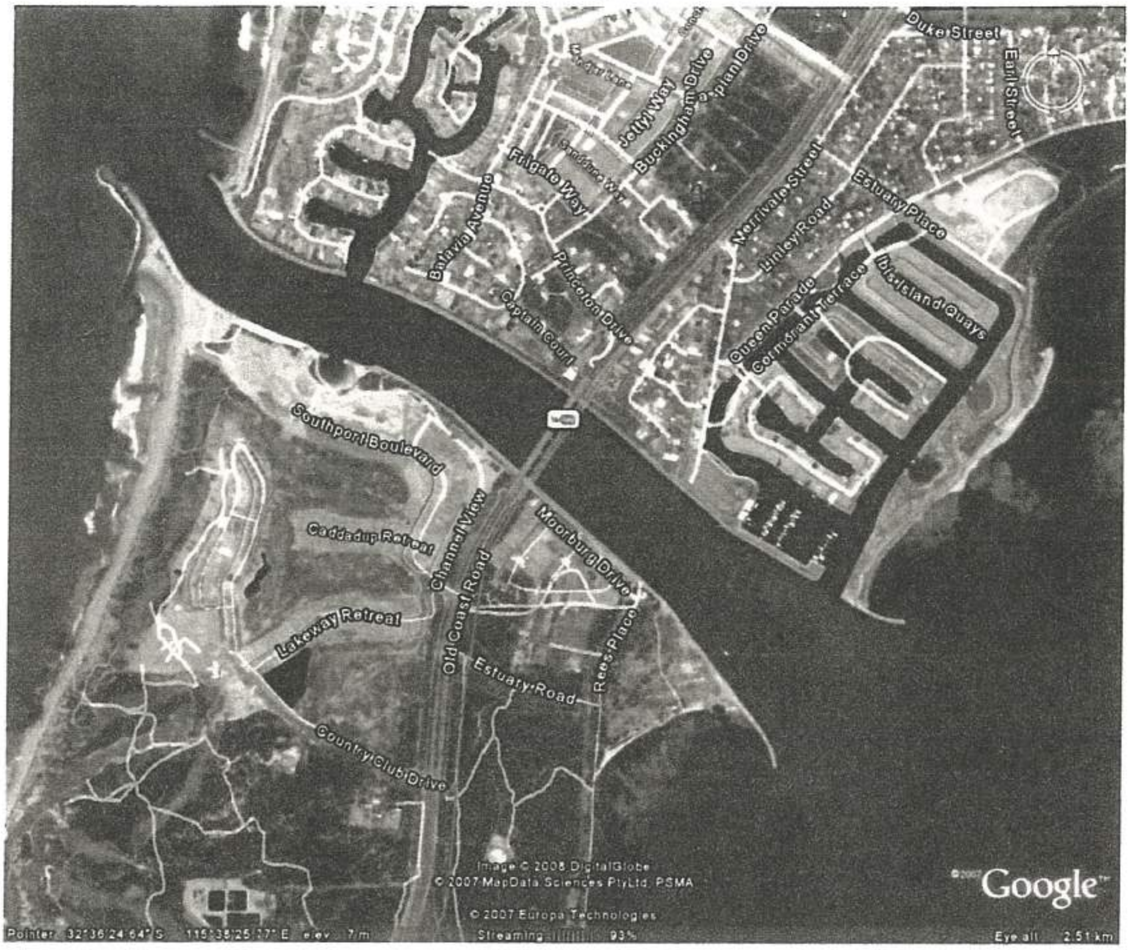
A total of 60,000 c.yds. of sand was dredged from the entrance and west of the west training wall, stockpiled and transported by road to the eroded foreshore at Wade Street and Orion Road.

Forty two Navigational Aids, including day markers and 8 navigational lights were installed in Peel Inlet and a 3 ton slipway was constructed at South Yunderup... A timber service wharf was constructed at the "Peninsula".

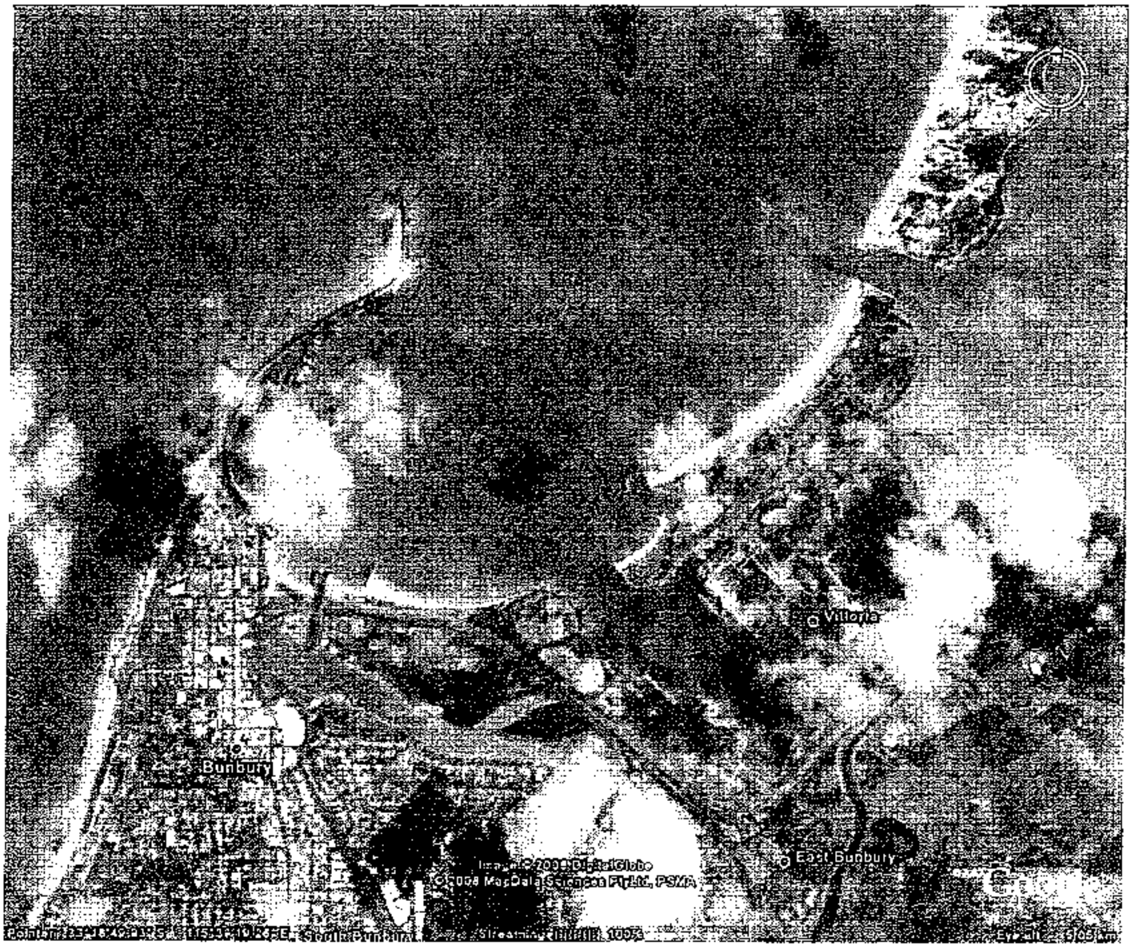
Extensive engineering and hydraulic investigations were completed to assess the feasibility and costs of a new ocean channel to Harvey Estuary (the Dawesville Channel) and recommendations submitted.



The Channel between the Ocean and Peel Inlet showing the canal and marina development centred around the channel 2008 google earth



The Dawesville Cut Mandurah 2007 google earth



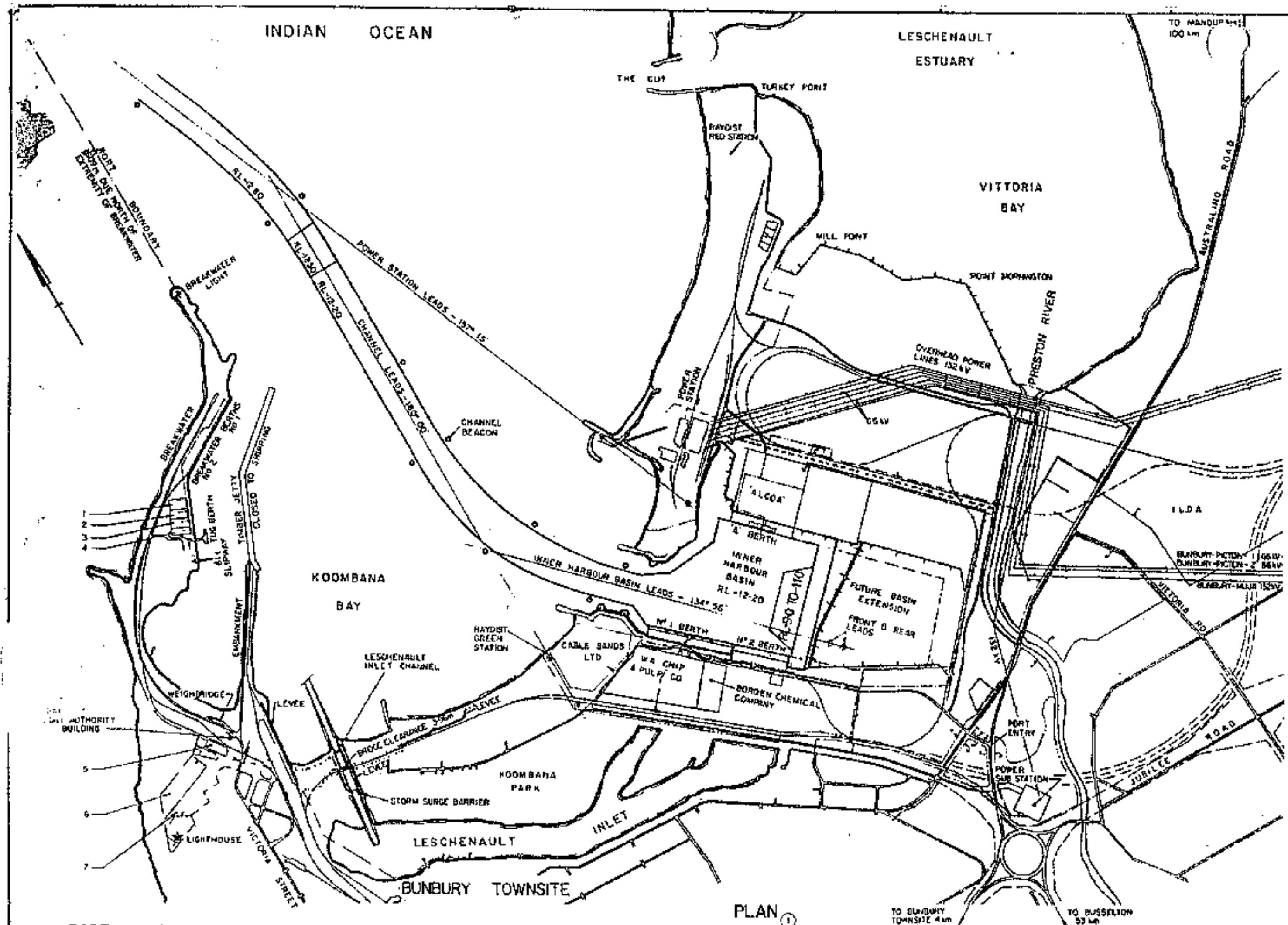
Bunbury Outer Harbour 2007 *google earth*

From left to right – Bunbury CBD and main breakwater. enclosing Koombana Bay, the entrance (the "plug") from the ocean to lower part of the Leschenault Estuary, the entrance to the inner harbour and the. entrance (the "cut") from the ocean to the upper part of the Leschenault Estuary.

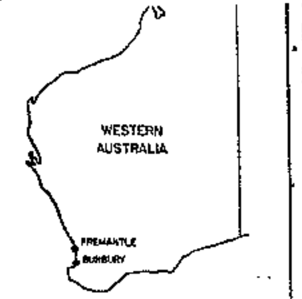
PORT OF BUNBURY LOCALITY PLAN

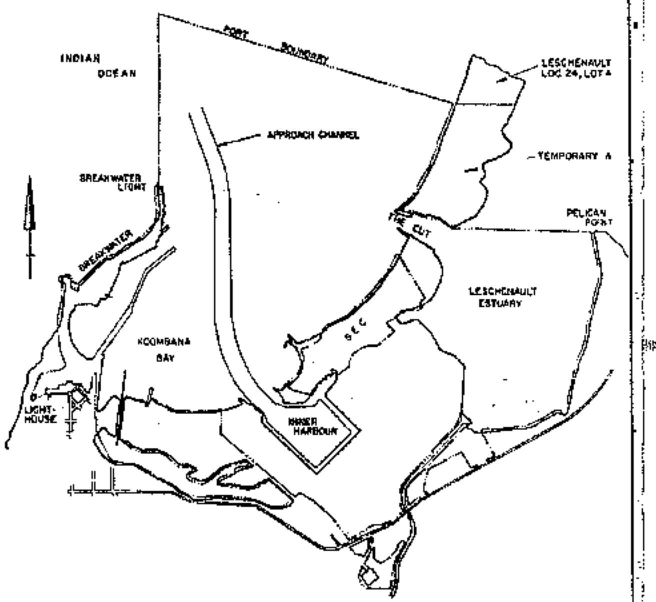
LEGEND OF LEASES

1. WESTERN TITANIUM LTD
2. CABLE SANDS LTD
3. WESTERN MINERAL SANDS
4. WESTRALIAN SANDS LTD
5. SHELL CO OF AUST LTD
6. MOBIL OIL AUST LTD
7. BP AUST LTD



PLAN ①





PORT BOUNDARY LIMIT ②

NOTE: SEE DRG 53923-9-4 FOR LIST OF REFERENCE PLANS

PORT INFORMATION

POSITION
LAT 33° 19' S., LONG 115° 38' E

DATUM
ZERO ON TIDE GAUGE WHICH IS 0·640m BELOW AHD, LOCATED ON TUG BERTH

ACCOMMODATION
OUTER HARBOUR (BREAKWATER BERTHS & TIMBER JETTY)

GOOD AND WELL DEFINED APPROACHES LEAD INTO BREAKWATER PROTECTED HARBOUR SITUATED IN KOOMBANA BAY WHICH IS SAFE IN ALL WEATHER CONDITIONS. BERTHING SPACE CONSISTS OF TWO BREAKWATER BERTHS, EACH 184m LONG. NUMBER 1 IS EQUIPPED WITH A MECHANICAL SHIP LOADER LINKED WITH ADJACENT STORAGE FOR THE EXPORT OF MINERAL SANDS. NUMBER 2 HAS GRAIN LOADING FACILITIES AND IS ALSO SUITABLE FOR GENERAL CARGO DISCHARGE. DEEPEST PERMISSABLE LOADED DRAFT IS 8·7m.

INNER HARBOUR:

GOOD AND WELL DEFINED APPROACHES LEAD INTO THE THREE INNER HARBOUR BERTHS WHICH ARE SAFE IN ALL WEATHER CONDITIONS. DEPTH ALONGSIDE EACH BERTH IS 12·2m. 'A' BERTH, ON THE NORTHERN SIDE, IS A DOLPHIN TYPE BERTH AND IS PRIVATELY OWNED AND OPERATED BY ALCOA OF AUSTRALIA LIMITED FOR THE EXPORT OF ALUMINA AND IMPORT OF LIQUID CAUSTIC SODA. No 1 BERTH, ON THE SOUTHERN SIDE, IS A DOLPHIN TYPE STRUCTURE AND CAN ACCOMMODATE SHIPS TO 240m IN LENGTH. W.A. CHIP & PULP CO PTY LTD CONDUCT A WOODCHIP EXPORT OPERATION FROM THIS BERTH. IT IS ALSO USED FOR THE DISCHARGE OF PETROLEUM PRODUCTS BY PIPELINE. No 2 BERTH IS ALSO ON THE SOUTHERN SIDE. IT IS A GENERAL PURPOSE BERTH 240m IN LENGTH AND CATERS FOR RAIL AND ROAD TRAFFIC. DEEPEST PERMISSABLE LOADED DRAFT AT EACH OF THE INNER HARBOUR BERTHS IS 11·6m.

IMPORTS
PHOSPHATE ROCK, AGRICULTURAL FERTILISERS, PETROLEUM, LIQUID CAUSTIC SODA & GENERAL CARGO.

EXPORTS
MINERAL SANDS, ALUMINA, WOODCHIPS, HARDWOODS, FRUIT & WHEAT.

CARGO HANDLING
OUTER HARBOUR (BREAKWATER BERTHS):

BY SHIPS GEAR, MOBILE CRANE, ON AND OFF RAILWAY WAGONS AND ROAD TRANSPORT. No 1 BERTH HAS A MODERN CONVEYOR SYSTEM TO LOAD MINERAL SANDS FROM IT. No 2 BERTH HAS A GANTRY TO BULK LOAD WHEAT INTO SHIP'S HOLDS.

INNER HARBOUR

No 1 BERTH HAS A MODERN CONVEYOR SYSTEM FOR LOADING WOODCHIPS INTO SHIPS HOLD, AND ALSO HAS FACILITIES FOR DISCHARGING OF PETROLEUM PRODUCTS BY PIPELINE. CARGO AT No 2 BERTH IS BY SHIPS' GEAR, ON AND OFF RAILWAY WAGONS AND ROAD TRANSPORT.

RAIL SERVICES
FULL RAILWAY FACILITIES ARE AVAILABLE ON ALL GENERAL CARGO BERTHS. THE RAIL TRACKS ARE CONNECTED WITH THE RAILWAY SYSTEM OF SOUTH WEST OF WESTERN AUSTRALIA

FRESHWATER
AVAILABLE FROM ALL BERTHS.

OIL SERVICE POINTS
BUNKERS MAY BE SUPPLIED AT ALL BERTHS BY ROAD EXCEPT AT 'A' BERTH. INNER HARBOUR No 1 BERTH HAS FACILITIES FOR THE DISCHARGE OF REFINED PETROLEUM PRODUCTS

ELECTRICAL SERVICES
FLOODLIGHTING IS SUPPLIED ON ALL BERTHS.

OUTER HARBOUR:

BREAKWATER BERTHS HAVE 30A & 100A 3 PHASE 440V 50Hz OUTLETS. TIMBER JETTY HAS 100A & 300A 3 PHASE 440V 50Hz OUTLETS.

INNER HARBOUR:

No 2 BERTH HAS 150A 3 PHASE, 55A 3 PHASE, 20A 3 PHASE AND 10A 1 PHASE OUTLETS.

ROAD SERVICES
ALL BERTHS ARE CONNECTED WITH THE STATE ROAD NETWORK.

PORT OPERATING AUTHORITY
BUNBURY PORT AUTHORITY.

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED AND MAXIMUM & MINIMUM TIDES RECORDED SINCE 1950 ARE +2·1m AND -0·3m RESPECTIVELY. PREDICTIONS ARE AVAILABLE.

PILOTAGE
PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER.

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATIONS

100 50 0 100 200 300 400 500 600 700
SCALE OF METRES ① (1:20000)

500 0 500 1000 1500
SCALE OF METRES ② (1:50000)

GENERAL NOTES

UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES

1. SEE DRG 53923-9-2, 9-3 & 9-4 FOR CROSS SECTIONS AND DESIGN LOADINGS.

A	3/85	RL-90 TO -110 ADDED	WS JHS
		REVISION	DRN APPD
SURVEY BOOKS		FILE No PW 1240/65	

SCALES AS SHOWN	DESIGN CALC	ROOF
MICROFILMED	CHECKED	BOOK
DATUM	DRAWN PJS	CHECKED CS/JHS
AS SHOWN	TRACED	CHECKED
	SUPERVISING DESIGN ENGINEER, H.B.R.	
	SUBMITTED DATE 27-12-79	CH. ENGINR
	APPROVED DATE 20-1-79	CHIEF ENG

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA

REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF BUNBURY
LOCALITY PLAN AND SERVICES DATA

W.D. 53923-9-1 REV A

43 Bunbury

Early History

A Military Post was established at Port Leschenault (Bunbury) in 1830 and the town of Bunbury was founded in 1842, being declared a port in 1855. In 1864 a 1400 feet length jetty was built between Casuarina Point and the opening to the Leschenault Inlet into seven feet of water. To give protection to the jetty, the construction of a breakwater off from Casuarina Point commenced on 1897.

Over the next 50 years or so both the jetty and the breakwater were progressively extended, the jetty seeking deeper water to take the deeper draft vessels using the port and the breakwater to give added protection to the extended jetty berths.

Harbour Development 1950s

Following the reballasting and upgrading of the rail sidings to Roelands Quarry in 1947 the quarry was reopened and rock became available in May 1947 for a further extension of the Bunbury Harbour breakwater, A new ocean outlet for the Leschenault Estuary was completed in May 1951 and a 600 feet by 87 feet wide extension of the timber Jetty, commenced in 1951, was completed in 1956. The resident engineer for the port works was John Gillespie followed by Max Anderson between 1952 and 1957. The Engineer, Harbours and Rivers was Norm Henry.

During this period a second Harbours and Rivers field organisation was established on the north shore at Bunbury to construct the circulating water intakes and foundations for the State Electricity Commission's Generating Station The resident engineer was Ralph Schrauf with assistant engineers Jim Butcher, Trevor :Leaver and Ron Leach.

In 1958 dredging tool place using the trailer suction dredge Sir James Mitchell with material being dredged from the outer harbour basin to reclamation behind the sites of the proposed No 1 and No 2 berths.

A contract was let to John Holland- Robinson Pty Ltd in January 1962 for 388,000 pounds for the construction of a 600 feet length reinforced concrete pile and deck land backed berth alongside the breakwater in the outer harbour. The purpose of this berth was for the handling of sulphur and phosphate using road transport. This berth was designed by Sydney consultants MacDonald Wagner and Priddle in conjunction with consulting engineer Don Fraser

In April 1965, tenders were called for a second breakwater berth, the contract being awarded to John Holland Constructions Pty. Ltd. for 481,063 pounds with the berth coming into operation in September 1966.

and Westrail. Service roads within the harbour area were constructed by the Main Roads Department and the Bunbury Town Council. The State Energy Commission provided the power supply and water mains were laid by the Public Works Department and connected to the Bunbury Water Board's supply. The Woodchip No 1 berth was built by the Harbours and Rivers branch day labour organization and consisted of six breasting dolphins fitted with flexible fender units, two mooring dolphins, and a central shiploader platform and access jetty The dolphins and platform were connected by steel walkways. The wharf was 381 metres long with a water depth of 12.2 metres, accommodating ships up to 44 800 tonnes drawing 11 metres of water. During loading operations the ship was warped back and forth alongside the ship loader. (1)

The resident engineer for the construction of this berth was Alan Forrest.

The Bunbury Inner Harbour was officially opened by Premier Court on April 2nd 1976. Speaking at the opening ceremony Sir Charles Court congratulated Sir John Parker and Mr. J.D. Gillespie on the concept of the scheme. At its commencement they occupied the positions of Director of Engineering and Engineer for Harbours and Rivers respectively.

The dredging of the lower Leschenault Inlet channel together with the concrete sleeving of the piles on the La Porte effluent structure and on the Fishermen's jetty in the outer harbour was completed.

A contract for the construction of No 2 inner harbour berth was awarded to John Holland Construction Pty Ltd in May 1978 for the sum of $ 2,222,504 and was completed in the following year. The berth was designed to take vessels of 68.000 tonnes loaded displacement with 12.30 meters depth of water at the berth.

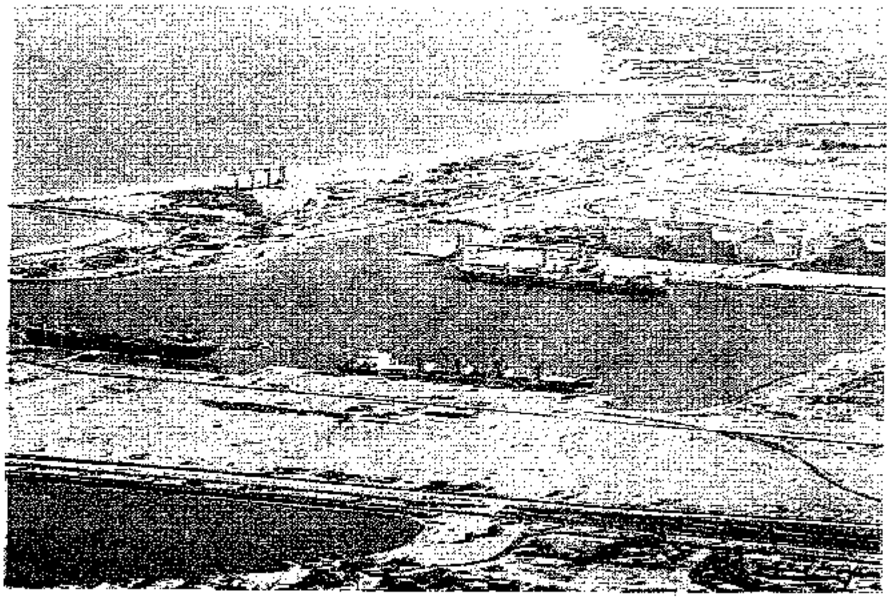
The resident engineer supervising this contract was initially Max Thorbjornsen, followed by Bill Till.

Precast concrete fender brackets were fixed to No 1 outer harbour berth. and a storm barrier was constricted in the lower estuary to minimize flooding of low lying areas of Bunbury was completed.

Between 1980 and 1982 the electrical installation on the inner harbour berth No 2 was completed Improvements to the power supply to the outer harbour were carried out for the Go-Operative Bulk Handling ship loader at the breakwater berths and for the upgrading of the mineral sands storage facilities.

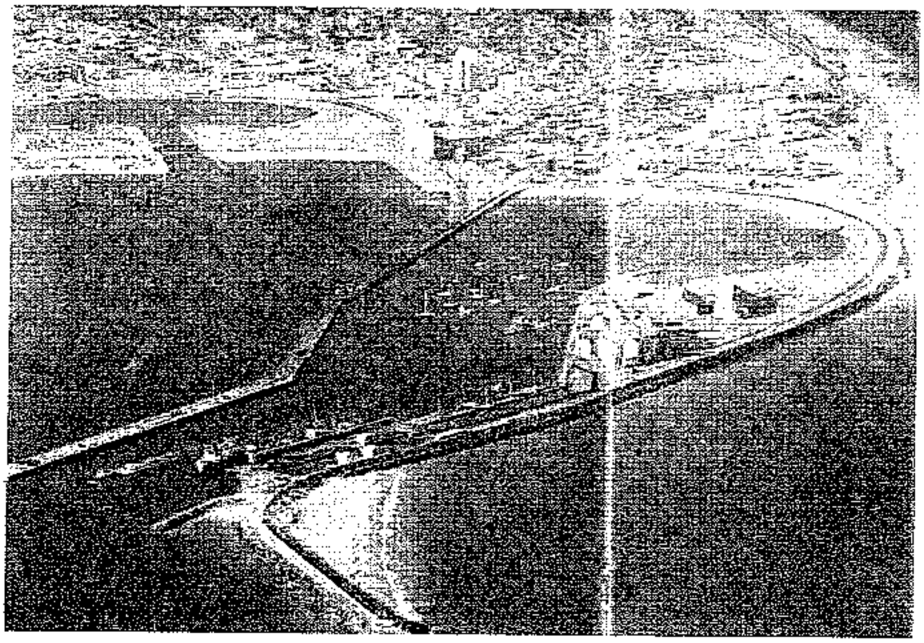
In 1983 modifications were made to the channel navigational aids and the main breakwater was extended by 70 metres

Reclamation for a hard standing area near the breakwater for commercial fishing was carried out and a fishing boat service jetty was completed.



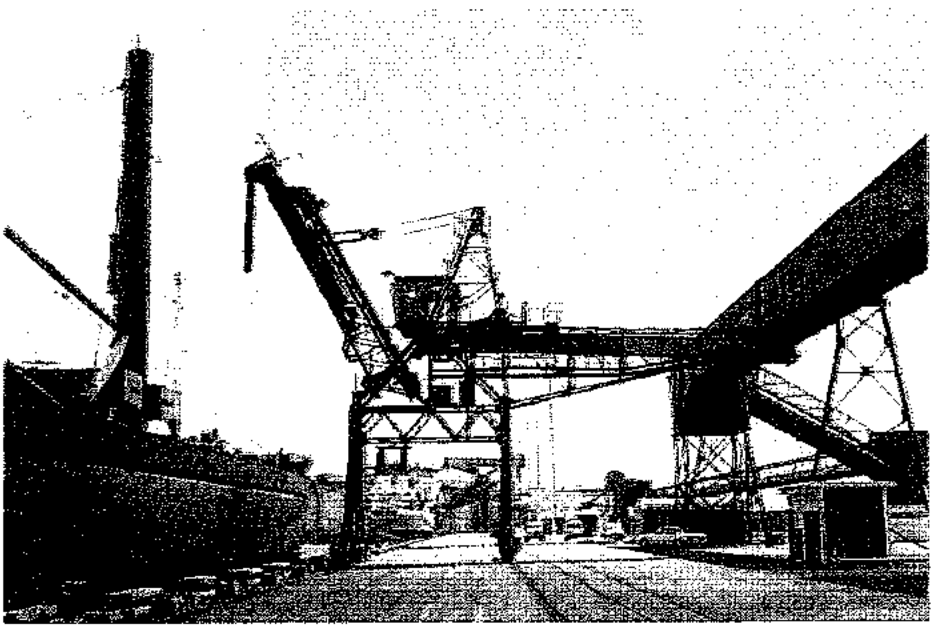
Bunbury Inner Harbour 1986 showing an alumina ship loading at the Alcoa Berth on the north side of the harbour with a ship alongside the No2 General purpose berth on the south side of the harbour and a wood chip vessel departing from the No 1 Berth on the left oft the photograph, The SEC Generating Station, since demolished is on the top left and the Ocean cut to the upper Leschenault Estuary is on the top right.

Acknowledgement – Bunbury Port Authority Annual Report 1986/87

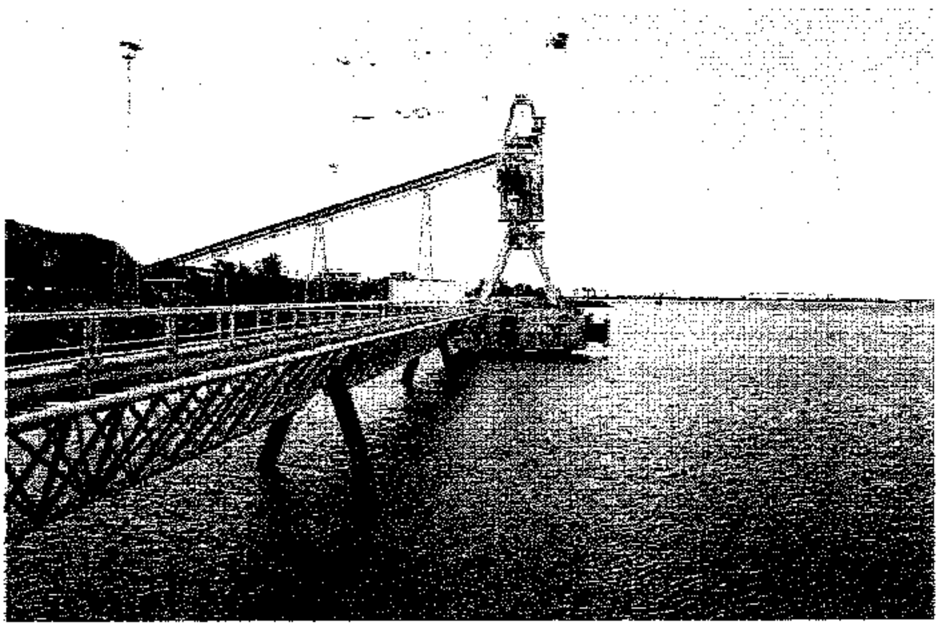


Bunbury Outer Harbour1986 showing the two breakwater berths and the old timber jetty with the Ocean entrance to the lower Leschenaut Estuary at the upper left. The tank farm on the top right has since been demolished and the land developed for housing

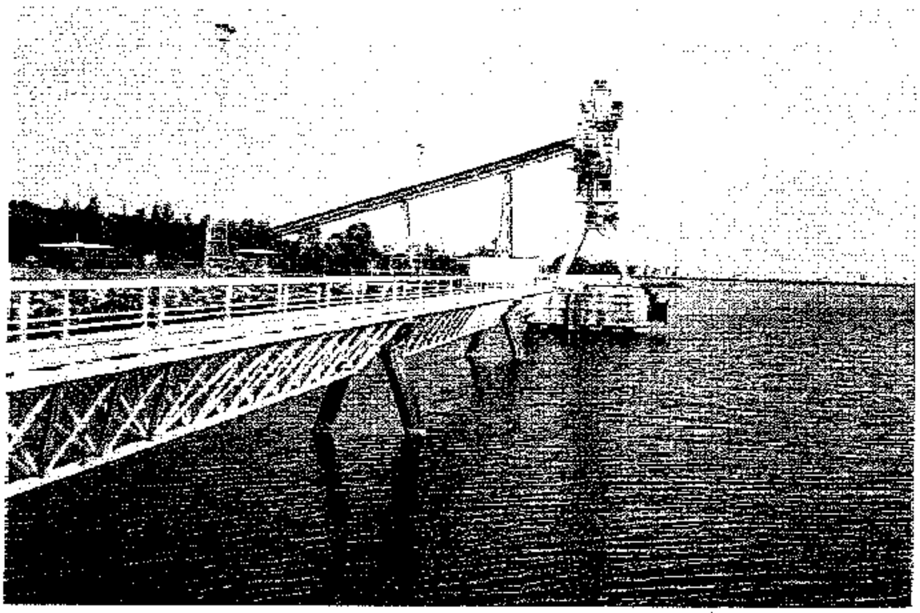
Acknowledgement – Bunbury Port Authority Annual Report 1986/87



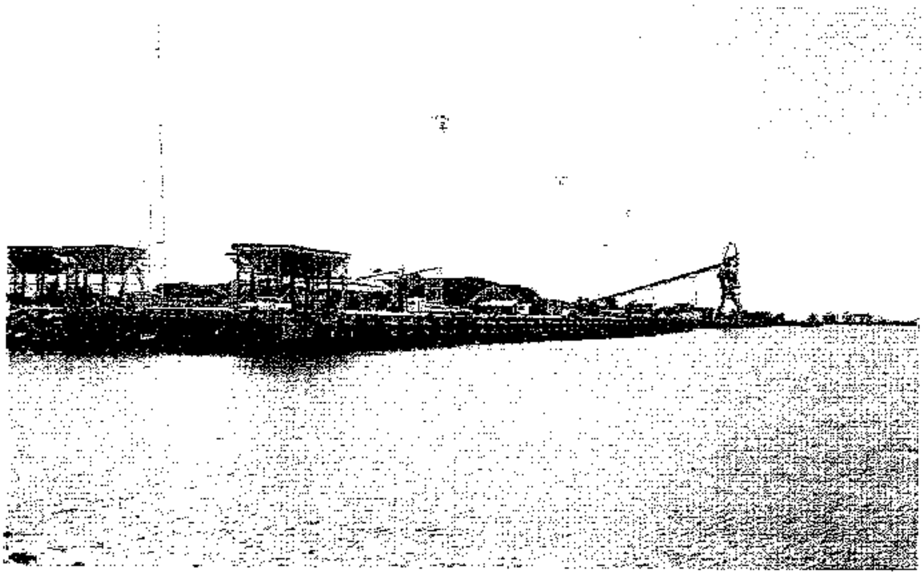
Bunbury Harbour the mineral sands loader at the No 1 outer harbour berth. The berth was 184 m long with a 15.85 m apron and was designed for a stack loading of 3400 kg.m2. The original fender system was replaced with Seibu C type rubber fenders allowing for the berthing load of a vessel with a 20,000 tonnes displacement. The ship loading rate was 900tph for mineral sands.



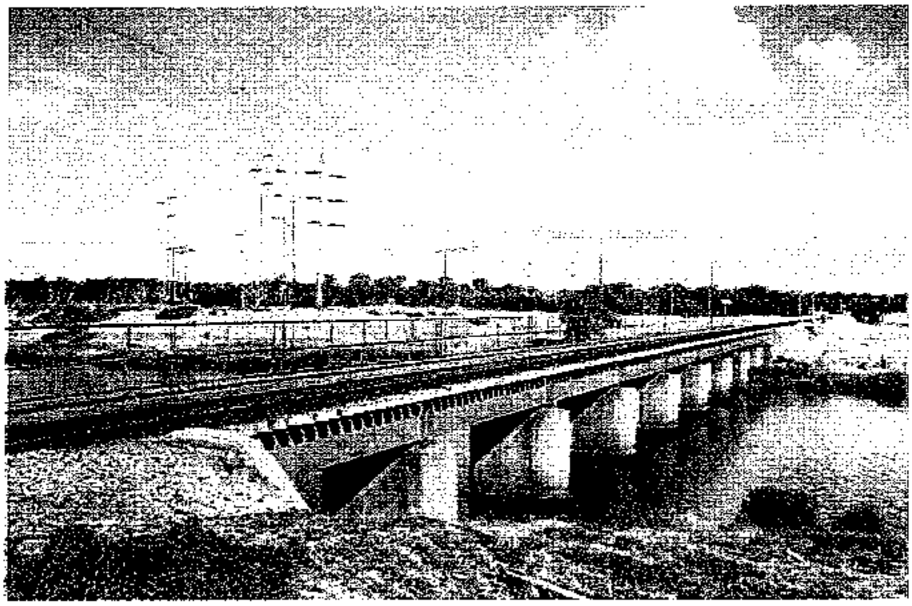
Bunbury Harbour - The inner harbour No 1woodchips dolphin type berth with an overall length of 381m. The fender system consisted of Bridgestone Cell Dock Rubber units providing for a berthing load of a vessel with 45,000 tonnes displacement. The fixed ship loader was rated at 1000 t /h.



The Bunbury Inner Harbour No 1 dolphin type berth - overall length 381m with a fixed ship loader rated at 1000 tonnes per hour for woodchips. The berth also has facilities for discharging petroleum products by pipeline to storage facilities located in the Outer Harbour. The fender system comprises of cylindrical type Bridgestone Cell Dock Rubber Fenders designed to take a berthing load from a vessel with 45,000 tonnes displacement - 21st February 1992.

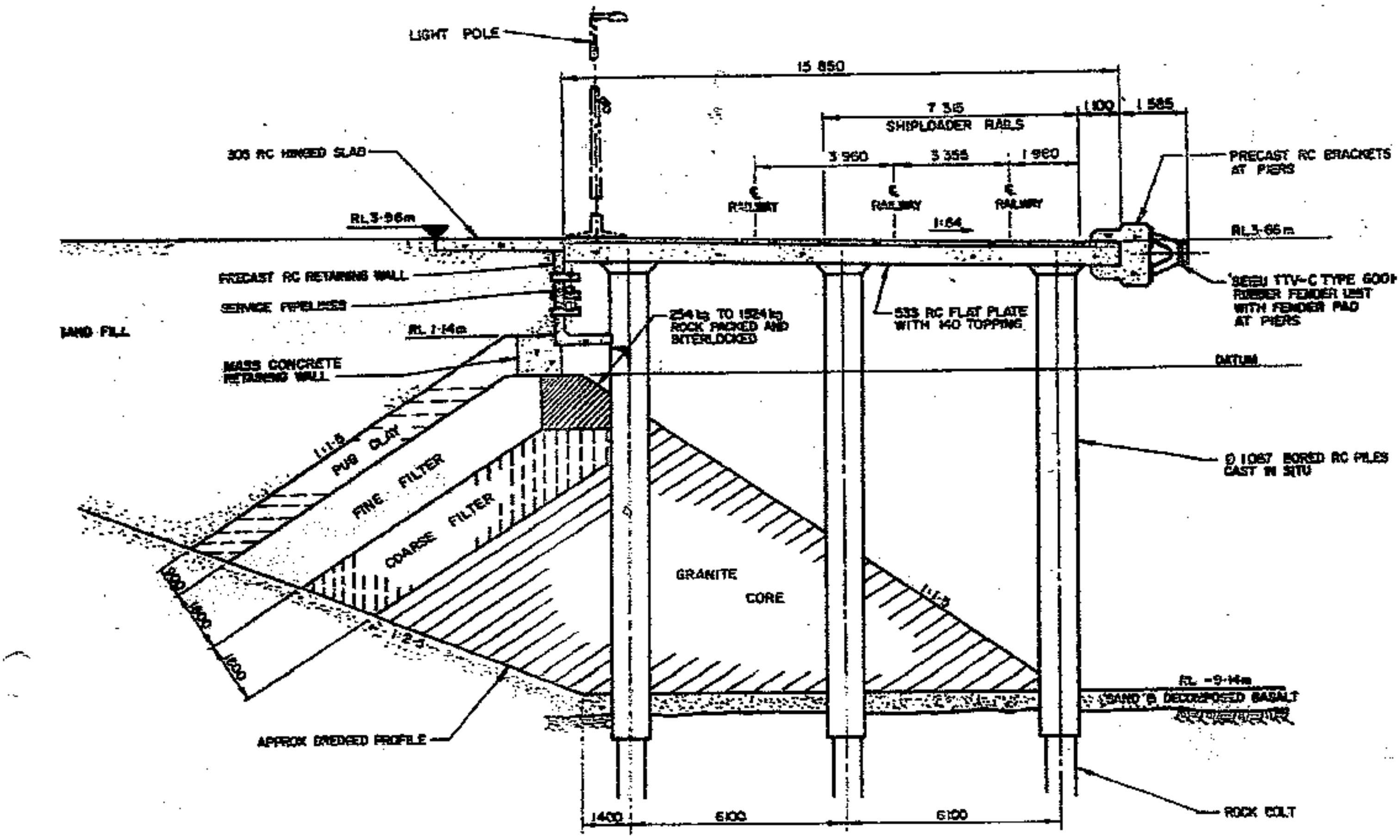


Bunbury Harbour - The inner harbour No 2 berth and No 1 berth, looking towards the harbour entrance. The No 2 berth is 240m in length with a 22.5 m apron and was designed for a stack load of 4,400 kg/m2 and a berthing load of a vessel of 68,000 tonnes displacement using Seibu V type rubber fenders.

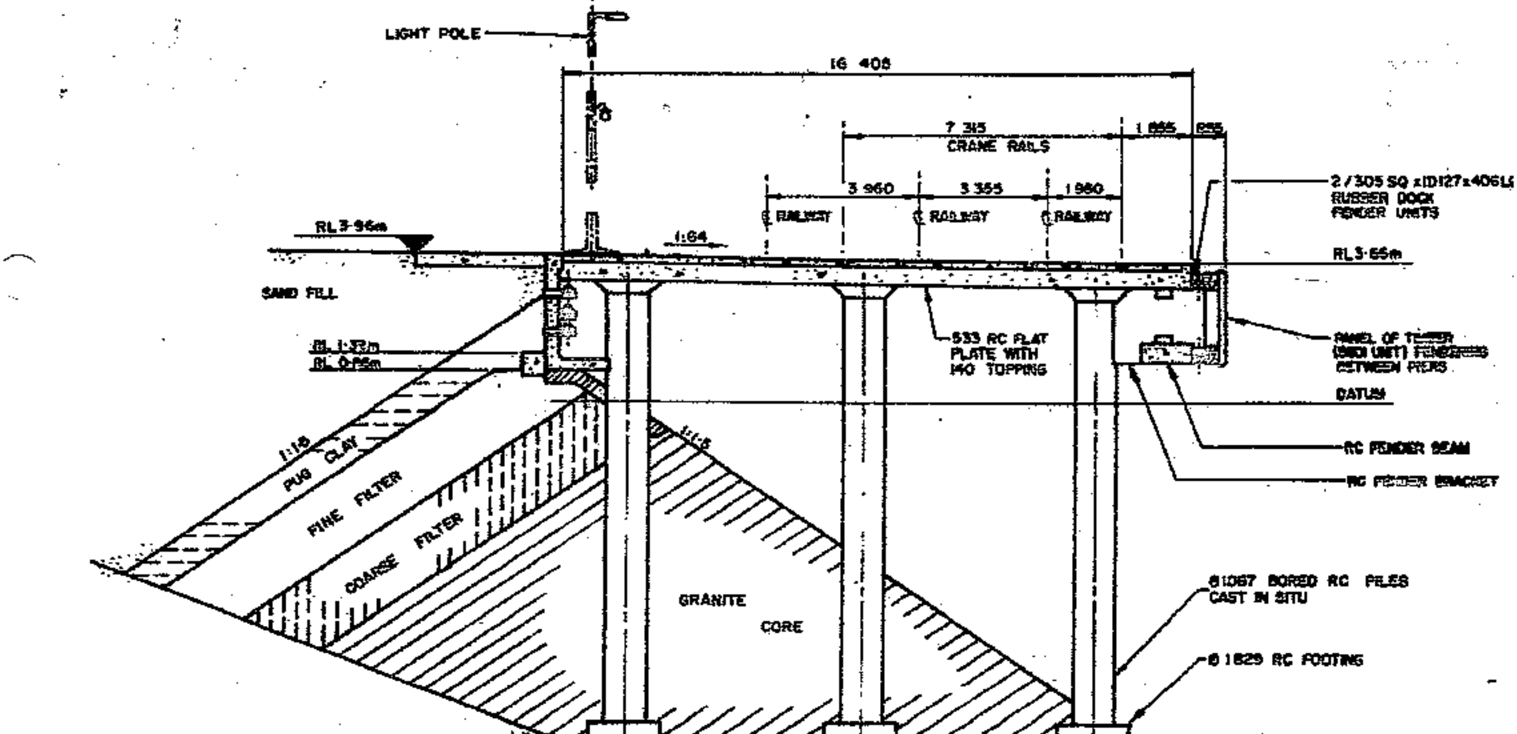


Bunbury Harbour - The rail access to the inner harbour over the bridge across the Preston River diversion -

The seaward extremity of the Bunbury main breakwater in the Outer Harbour showing the concrete parapet wall and the 1983 breakwater extension - 21st February 1992,



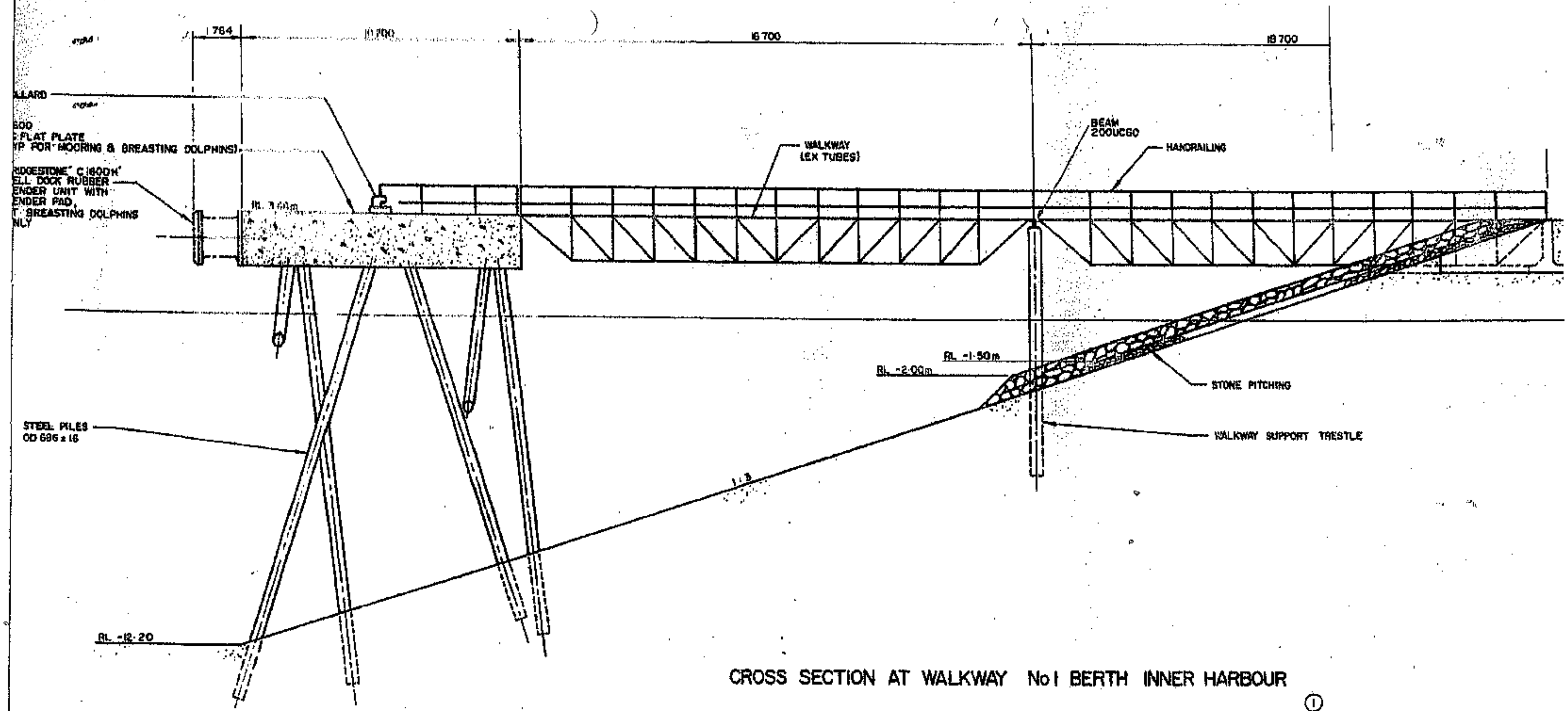
No 1 BERTH TYPICAL SECTION ①
(PIERS AT 6 095 CENTRES)



No 2 BERTH TYPICAL SECTION ①
(PIERS AT 6 095 CENTRES)

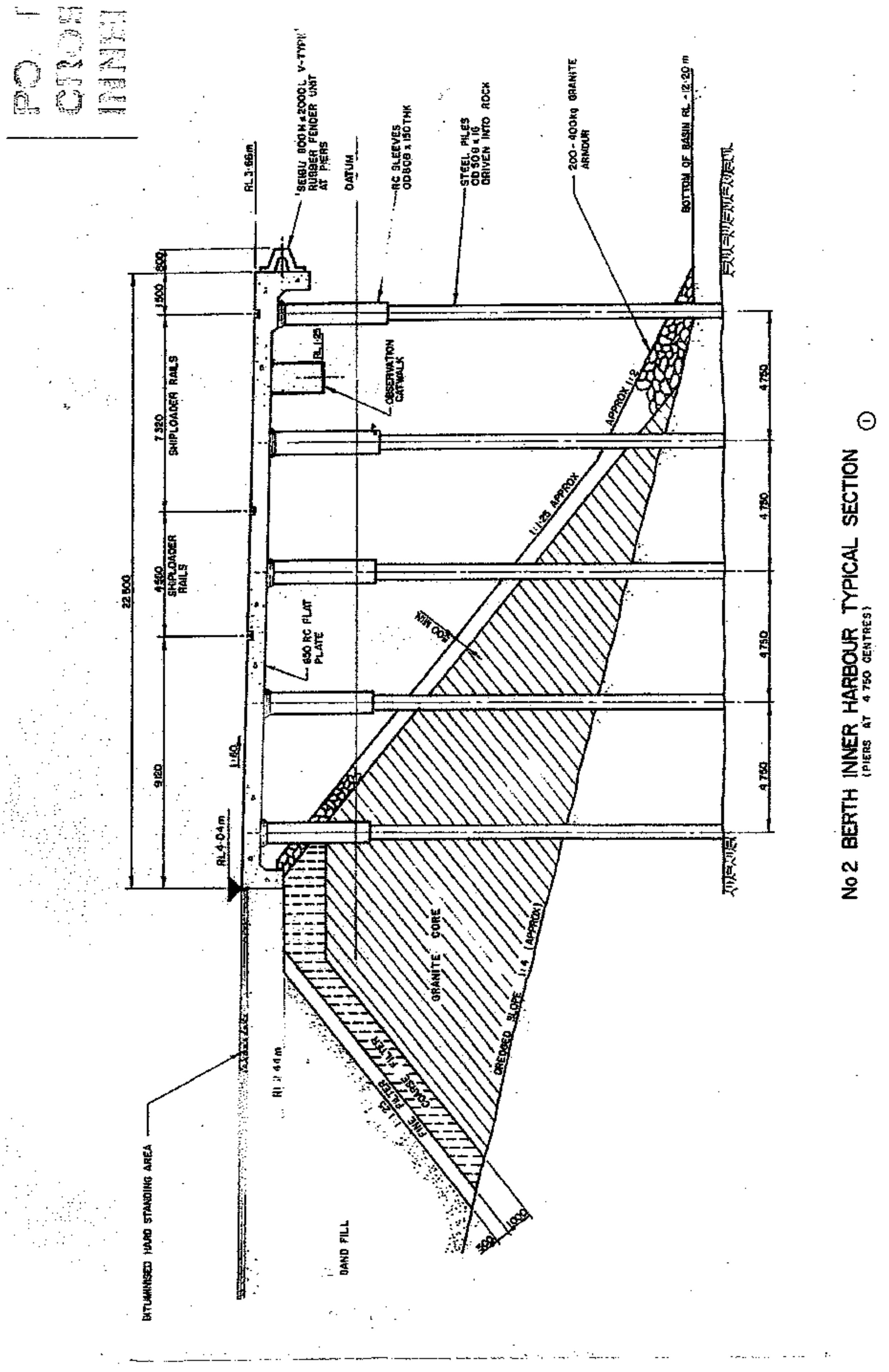
WATER BERTHS

PORT OF BUNBURY
CROSS SECTIONS OF OUTER HARBOUR
BERTHS 1 AND 2

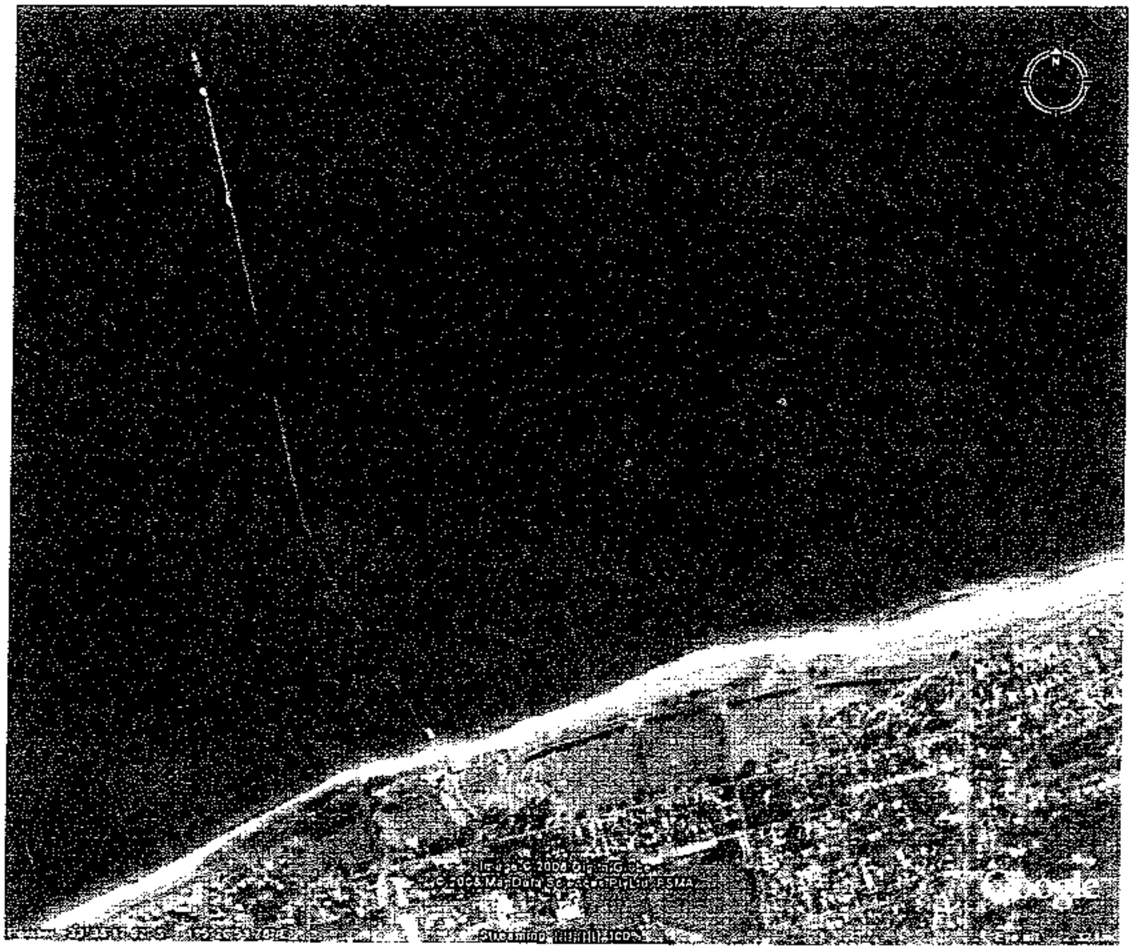


CROSS SECTION AT WALKWAY No I BERTH INNER HARBOUR

PORT OF BUNBURY
CROSS SECTION OF INNER HARBOUR
BERTH 1 AND WALKWAY



PORT OF BUNBURY
CROSS SECTION OF INNER HAROUR
BERTH 2



Busselton Jetty 2007 google earth

44 Busselton

Early History

There are records of five jetties having been built in the Busselton Augusta area in the late 1800s. the earliest one being at Busselton in 1864/65

Flinders Bay

The first jetty built in the Augusta area was at Barrack Point, Flinders Bay for the export of timber. In 1880 this jetty was described as initially being 800 feet (244 metres) long and ultimately being extended to 1,100 feet (335 metres).

Hamelin Bay

In 1881, as an alternative to Augusta a 500 feet (152 metres) long jetty was built at Hamelin Bay and which carried a light tramway. When the Karridale Mill was built in 1887 the Hamelin Bay Jetty was extended to 1,800 feet (545 metres).

Quindalup

In 1897 a 635 feet (194 metres) long jetty was built at Quindalup for the export of timber from the Yelverton Mills

Lockeville

A loading point for timber east of Busselton from the WA Timber Company was established in 1869. In 1871 a jetty was built at Lockeville at the mouth of the Wonerup Estuary together with a 14 span bridge of 120 feet (36 metres) long across the estuary,

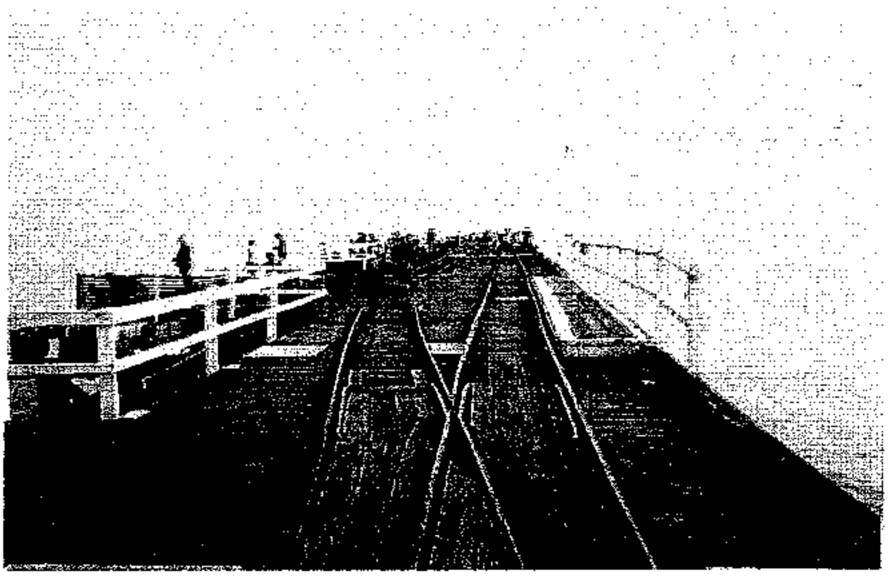
Busselton Harbour Development 1950s

The original timber Jetty at Busselton, which was built in 1864/65, was 528 feet in length. Between 1875 and 1961 it was extended eight times, with the last extension resulting in a Jetty with a total length of 6306 feet. The Busselton Jetty was closed to shipping as from September lst 1972. Maintenance of the Jetty, now a non revenue producing facility, continued until March 1973 when it was handed over to the Shire of Busselton.

The engineer supervising one of the major post 1950 extensions and fender system replacement was Trevor Leaver, the Engineer for Harbours and Rivers at the time being NJ Henry.

A slipway was constructed on the seaward side of the junction of the promenade jetty and the railway jetty in the early 1950ss, the resident engineer being Byron Cornish and the Engineer for Harbours and Rivers at the time being NJ Henry.

In April 1978, the pedestrian promenade approach to the Busselton Jetty was destroyed and other sections severely damaged. by Cyclone Alby.
During 1978/79, extensive repair work was undertaken to ensure safe pedestrian access to the outer section of the jetty. This included the replacement of 39 piles as well as the installation of a handrail and lighting on the railway viaduct.
Busselton jetty is now used solely for recreational purposes and is under the control of the Shire of Busselton
In 1981 boat launching facilities were provided east of the Busselton jetty.



The existing head of the Busselton jetty with pedestrians taking the place of cargo

45 Augusta

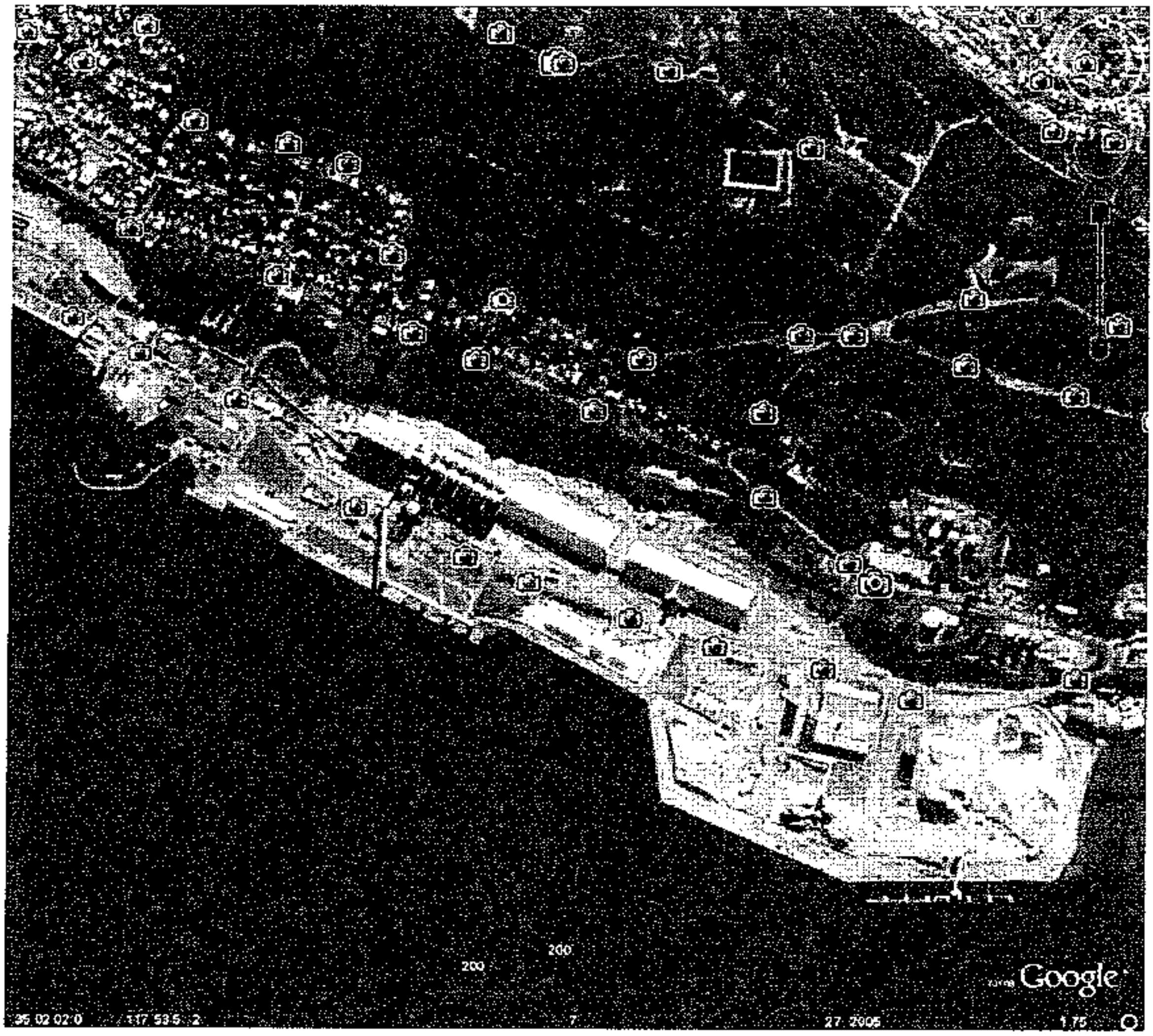
To provide better small craft access from Hardy Inlet into the Blackwood River at Augusta a channel was blasted through Hardy Inlet in the early 1950s. At that time there were no public Jetties or mooring facilities at Augusta.

In 1972 and 1973 maintenance dredging was carried out on the channel through Hardy Inlet with the removal of 65,000 c.yds of material.

A new fishermen's service jetty in Hardy Inlet at the end of Ellis Street was completed and opened on 15 Nov 1984 by the Hon Minister for Works.

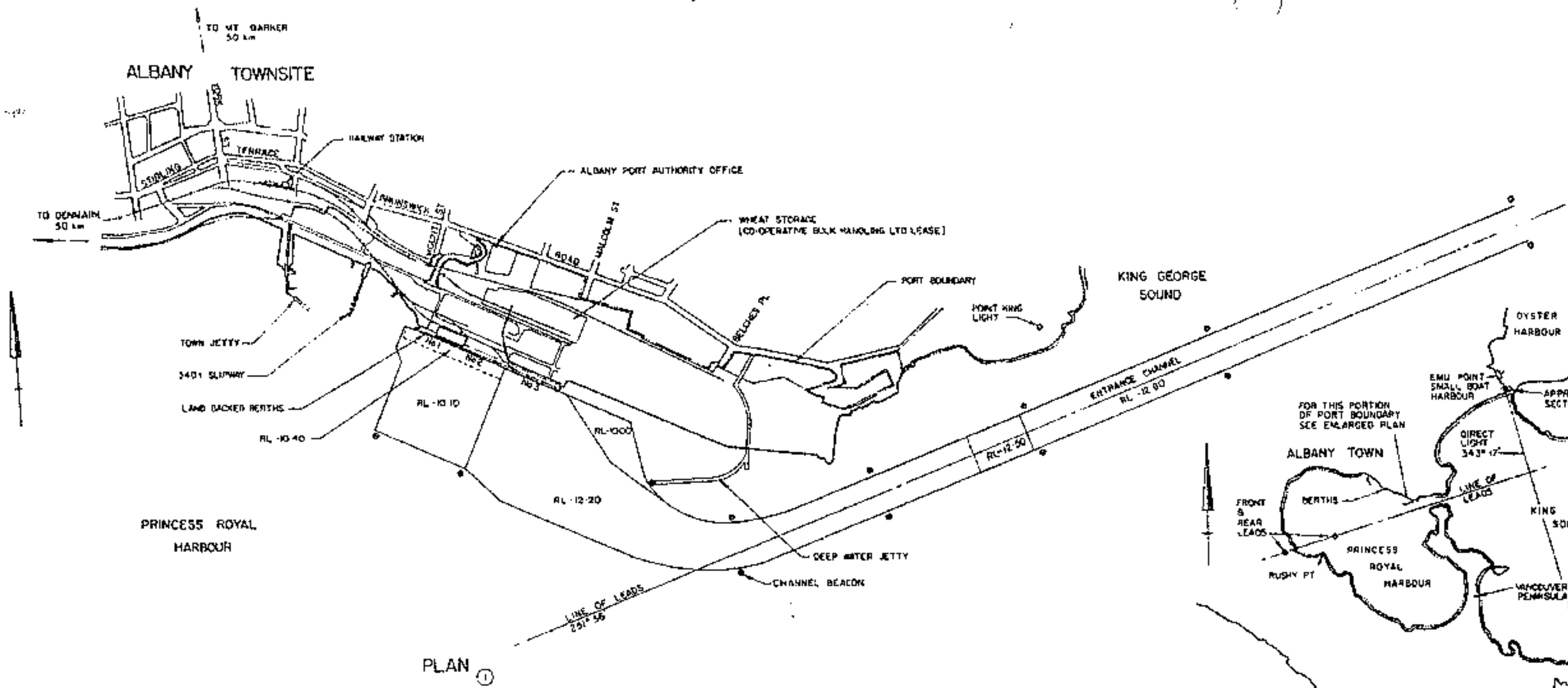
Government and private jetties in Hardy Inlet at the foot of Ellis Street, Augusta with the 1984 Government jetty at the top left hand side of the aerial.

Great Southern

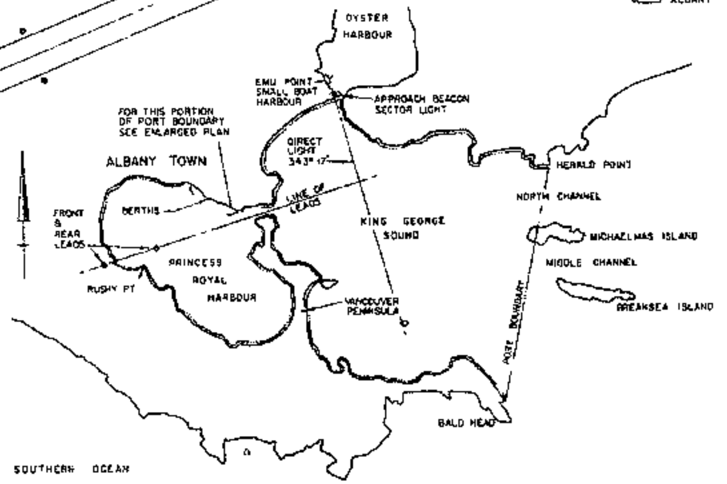


The Port of Albany 2008 *google earth*

PORT OF ALBANY LOCALITY PLAN



PLAN ①



PORT BOUNDARY LIMIT ②

PORT INFORMATION

POSITION
LAT 35° 02' S , LONG 117° 53' E

DATUM
LWM ALBANY (CHART DATUM) WHICH IS ZERO ON THE TIDE GAUGE AND 0.77m BELOW AHD

ACCOMMODATION
WELL DEFINED APPROACHES THROUGH NARROW ENTRANCE CHANNEL LEAD INTO PRINCESS ROYAL HARBOUR , A LAND LOCKED HARBOUR AT THE HEAD OF KING GEORGE SOUND . HARBOUR WATERS EMBRACE 2 330ha WHICH ARE SAFE IN ALL WEATHER CONDITIONS. LAND BACKED BERTHS (No 1, 2 & 3) PROVIDE 3 BERTHS WITH AN OVERALL LENGTH OF 607m. DEPTH ALONGSIDE No 1 & 2 BERTH IS 10.4m, WHILST IT IS 12.2m AT No 3 BERTH. GOODS SHEDS, BONDED STORE & CUSTOMS OFFICERS ARE AVAILABLE

IMPORTS
GENERAL CARGO, ROCK PHOSPHATE , SULPHUR AND PETROLEUM PRODUCTS

EXPORTS
WOOL , SHEEP, MEAT , WHEAT , OATS AND BARLEY

CARGO HANDLING
ON LAND BACKED BERTHS SHIPS GEAR ON AND OFF RAILWAY WAGONS AND ROAD TRANSPORT. A 5 TONNE MOBILE CRANE AND AN 8 TONNE MOBILE CRANE ARE ALSO AVAILABLE. BULK WHEAT IS LOADED FROM A MODERN CONVEYOR SYSTEM OPERATING FROM No 1 BERTH

RAIL SERVICES
FULL FACILITIES ARE AVAILABLE ON ALL BERTHS. THE RAIL TRACKS ARE CONNECTED WITH THE RAILWAY SYSTEM OF THE SOUTH WEST OF WESTERN AUSTRALIA

FRESH WATER
AVAILABLE FROM ALL BERTHS

OIL SERVICE POINTS
DISCHARGE OF REFINED PETROLEUM PRODUCTS IS FROM No 1 & 2 BERTHS

ELECTRICAL SERVICES
FLOODLIGHTING IS PROVIDED FOR No 3 BERTH , ELSEWHERE THERE IS GENERAL LIGHTING. 100A 4 PIN 3 PHASE 440V 50Hz DECONTACTOR OUTLETS AND 10A SINGLE PHASE 250V 50Hz OUTLETS ARE PROVIDED ON No 1, 2 & 3 BERTHS

ROAD SERVICES
ROAD SERVICES CONNECT THE LAND BACKED BERTHS WITH THE STATE ROAD NETWORK.

REPAIR FACILITIES
FAIRLY EXTENSIVE REPAIRS ARE POSSIBLE

PORT OPERATING AUTHORITY
ALBANY PORT AUTHORITY

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED AND THE MAXIMUM AND MINIMUM TIDES RECORDED SINCE 1951 ARE +1.8m AND -0.1m RESPECTIVELY. PREDICTIONS ARE AVAILABLE

PILOTAGE
PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATIONS - 'CLIMATIC SURVEY' - ALBANY - REGION 12 - WESTERN AUSTRALIA

REFERENCE PLANS

REFERENCE PLANS	PWD., WA
BERTHS	
No 1 & 2	36784
SOUNDINGS - 1981	55821
No 1 & 3 EXTN	44489, 51413, 46426
No 3	
FENDERING	53190
SOUNDINGS - 1979/80	50029 BK 2
SLIPWAY - 3401	47289
DEEP WATER JETTY	17748
TOWN JETTY	47836
PORT BOUNDARY	45591, 32902
DREDGING & RECLAMATION - 1977	50656
NAVIGATION AIDS	53197
HYDROGRAPHIC SURVEY - 1981	52923
EMU POINT SMALL BOAT HARBOUR	50856
ADMIRALTY CHARTS	AUS 118, BA 1034

00 50 0 100 200 300 400 500 600 700
SCALE OF METRES ①
(1:20 000)

1000 0 1000 2000 3000 4000 5000 6000 7000
SCALE OF METRES ②
(1:200 000)

GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES
1. SEE SHS 53925-BT-2 FOR CROSS SECTIONS AND DESIGN LOADINGS

SCALES AS SHOWN	DESIGN CALC	BOOK	PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
MICROFILMED	CHECKED	BOOK	REGIONAL PORTS OF WESTERN AUSTRALIA
DATUM	DRAWN PJS	CHECKED CS/JHS	PORT OF ALBANY
AS SHOWN	TRACED	CHECKED	LOCALITY PLAN AND SERVICES DATA
	SUPERVISING DESIGN ENGINEER H.G.R		
	SUBMITTED	DATE 29 12 87	APPROVED DATE
			53923-10-1

ZONE	DATE	REVISION		DRAWN	APPROVED

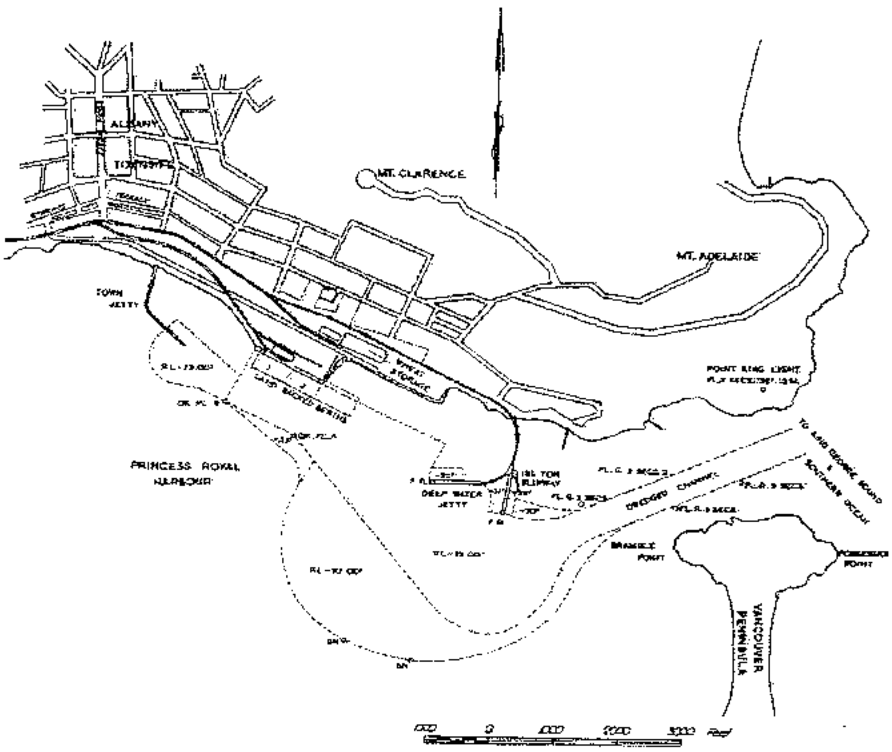
46 Albany

Early Development

Albany was proclaimed a township in 1832 and a small jetty was built at the end of Osnaburg' Street (now Bridge Street). In 1850 another small jetty was built at the foot of York Street. Other jetties which followed were the P & O coaling jetty just east of Bridge Street, in 1852, the town jetty at Spencer Street which was commenced in 1861 and completed in 1865, the Quaranup jetty for the Quaranteen Station at Geak: Point in 1874, a jetty for the WA Land Company in 1888 and the extension of the town jetty to 1568 feet in 1892. The 2016 feet length Deep Water Jetty near the entrance to Princess Royal Harbour was built in 1904. In 1929 the port had two jetties - the now 1970 feet long Town Jetty with two 400 feet long berths in 23 feet of water and the other the 3,214 feet length Deep Water Jetty with 32 feet of water at its outer berths,

Harbour Development 1950s

In the early 1950s a scheme for the development of Albany Harbour as devised by Frank Tydeman, Engineer for Harbours and Rivers (1948 to 1952), was implemented. It involved the construction of land backed berths and other port ancillaries and the dredging of the harbour basin, approach channel and berths.



The Tydeman Plan

In 1950 a new transit shed was erected on reclaimed land near the railway yards and provision made in the design for the Harbour Board office to be located in a corner of the building. A 135 ton slipway was built alongside the old arm of the Deep Water Jetty and completed in 1950.

In late 1950 the Department's new cutter suction dredge *Sir James Mitchell* arrived in Albany and commenced dredging on November 28th 1950 for the removal of about 1,500,000 cubic yards of material estimated to take up to about 5 years, In order to speeds up the work additional dredging plant was engaged when a contract was negotiated with a Dutch dredging company, the Australian Dredging Company.

Using on self propelled bucker dredge, one non propelled cutter suction dredge, three barges, one 300 HP tug, one 25 ft .workboat, one oil barge and 1,400 feet of 21"floating delivery pipe, work commenced in February 1952 and was completed in September of the same year, with the dredging of 1,400,000 cubic yards of material, which was pumped to the reclamation area/

At the same time the *Sir James Mitchell* worked in the entrance channel and swinging basin outside the contract area, deepening shallow areas to 34 feet below low water mark.

Pile driving on the first land backed berth commenced in September 1953 and was completed in November 1954. The wharf consisted of reinforced concrete octagonal piles, timber halfcaps and beams and a reinforced concrete deck. The first unloading of phosphate rock for the new works of the Albany Superphosphate Company took place in March 195 and in 1956 Co-operative Bulk Handling Limited opened the first stage of its bulk grain terminal which made a huge difference to the volume of cargo through the port. Construction of the second berth followed immediately and was available for shipping in September 1957.

The resident engineer for the project was Ed Gorham with assistant engineers Trevor Leaver and Max Thorbjornsen and the Engineer, Harbours and Rivers was F Tydeman who was succeeded by NJ Henry in1952.

Harbour Development 1960 - 1985

In January 1969 a contract was awarded to PDC Constructions for the construction of the 640 feet length No 3 Berth and a 94 feet extension of No 1 Berth for the sum of $ 2, 1043,339. Work commenced in April 1969 and was completed in 1971.

The resident engineer supervising this contract was Bill Andrew and the Engineer, Harbours and Rivers was JD Gillespie who was succeeded by MG Anderson in 1972,

In 1971/72 the 135 ton capacity slipway was reconstructed

In 1972 the old deepwater Jetty east arm was closed and demolished and oil receivals were transferred to the west arm of the Jetty, Work commenced on a new 300 ton capacity slipway at Albany to ultimately replace the 135 ton capacity slipway. At this time the Pubic Works Department was operating slipways at Fremantle Harbour (No 1 -2,750 tons capacity and No2 - 600 tons capacity), one 80 ton capacity at Bunbury, one 10 ton capacity at Shark Bay and one 30 ton capacity at Geraldton.)

An extension of 42 feet to Albany No 1 berth and 106 feet to Albany No 3 berth was completed in January 1973 and the old arm of the Jetty was removed... Two steel pile navigational beacons were installed on the Outer Approach Channel to replace the old timber structures and a new mooring was being replaced at Frenchman's Bay for the Cheynes Beach Whaling Company

The construction of a new 300 ton capacity slipway with the provision for upgrading up to 600 ton was completed and a mooring structure and service building for Harbour and Light Department was built at the town jetty. The old slipway on the deepwater Jetty was demolished.

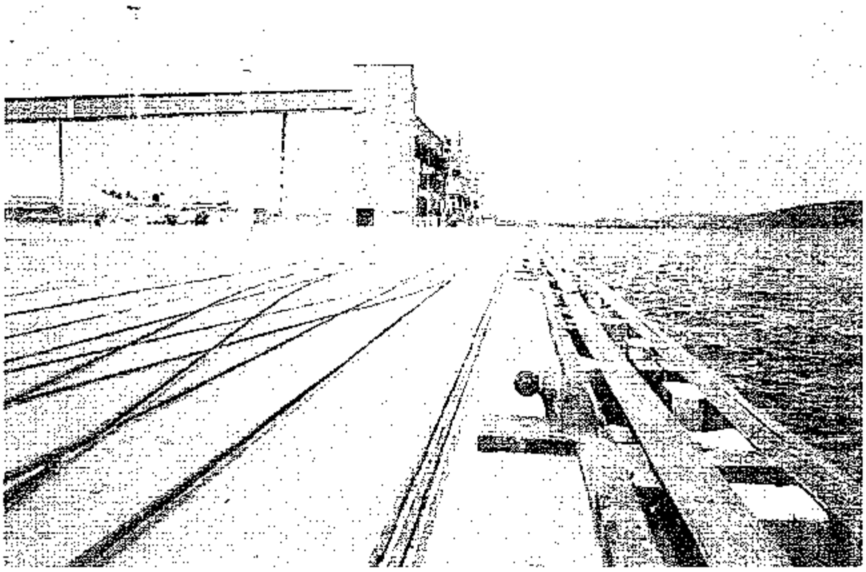
In 1975/76 investigations into a proposed fishing boat harbour were commenced and planning progressed for the deepening of the harbour

The dredging and reclamation works associated with the deepening of the harbour to 12.2 metres were completed in 1979 with the removal of 1.25 million cubic .metres of sand and 21,000 cubic metres of rock from the harbour basin. New oil bunkering facilities were completed.

In 1979/80 a Contract was awarded for grab dredging at the face of No 1 and 2 berths. A contract for the construction of an underwater sheet pile wall at No 3 berth together with the installation of rubber fender units at No 3 berth was completed. New navigational aids were installed in the harbour.
Bulk loading equipment at No 3 berth owned and operated by CBH (Cooperative Bulk Handling) was now able to load vessels at the rate 1600 tonnes per hour. The three berths now form a continuous face of 508m. The No 3 berth fender system was upgraded in 1979 and comprises Bridgestone cell type rubber fender units mounted on precast concrete blocks and fixed to the face of the existing structure.
This allows for the berthing of vessels of up to 60,000 tones loaded displacement with 50% of the kinetic energy of berthing loads being absorbed by the structure. The permissible draft of vessels using this berth was 11.5m.)

In 1980 two navigational aids were installed in the outer harbour and two can buoys were installed in King George Sound.
A jetty was also constructed at Middleton Beach.
Tenders were called for the design and construction of a white oil products line to No 1 and No 2 berths.

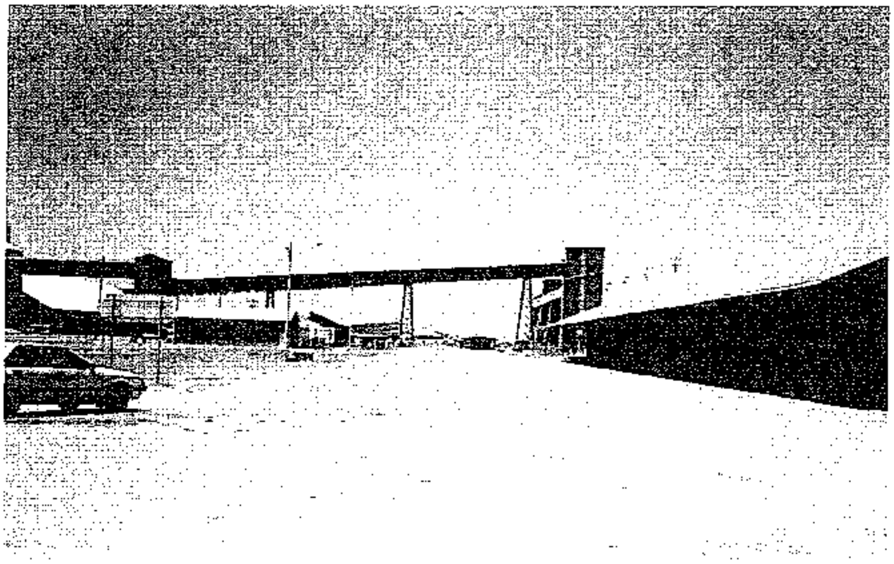
Between 1981 and 1985 a new white oil pipeline was constructed to No I and 2 berths to replace the existing oil line on the deepwater Jetty. Navigation beacons marking the inner basin were provided and a sector light marking the outer approaches to the harbour was installed.
A new tug berth was constructed at the old town Jetty and. modifications were carried out to the 320 tonne slipway.



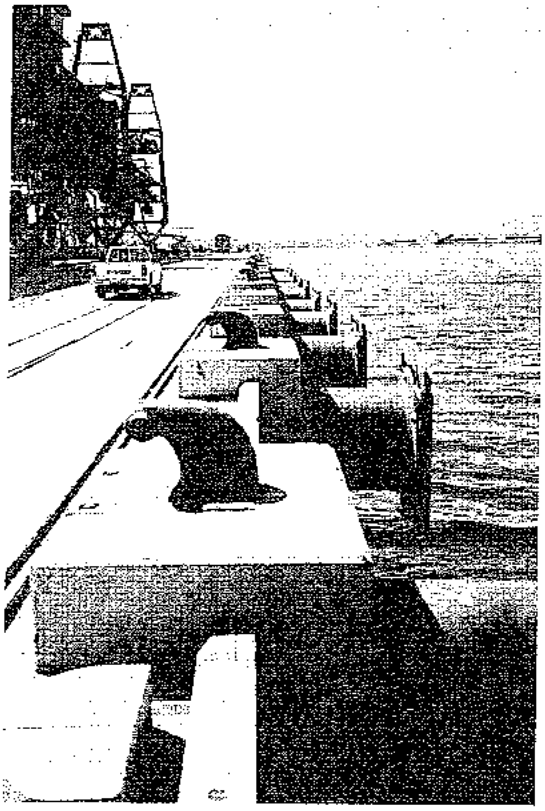
Albany Harbour - Taken from the western end of No 1 Berth looking south east along No 2 berth to No 3 berth-The deck of No I and No 2 berths consisted of a thin reinforced concrete slab placed over longitudinal karri beams supported on karri cross girders.

The super structure was supported on octagonal reinforced concrete piles. The concrete deck has a stack loading of 2,400 kgm/m2 and the timber spring pile and timber fender system has been designed to take a berthing load of a 20,000 t displacement vessel with 50% of the kinetic energy being absorbed by the wharf structure. No 1 berth was 209m in length and the deepest permissible draft of vessels using this berth was 9.8m. This berth was used mainly for general and bulk cargoes. There was a transit shed of 4,300 m2 of floor space immediately behind the berth. No 2 berth which had similar loading and draft limitations was used for general cargo and for the discharging of petroleum products, previously discharged over the "deep water Jetty"

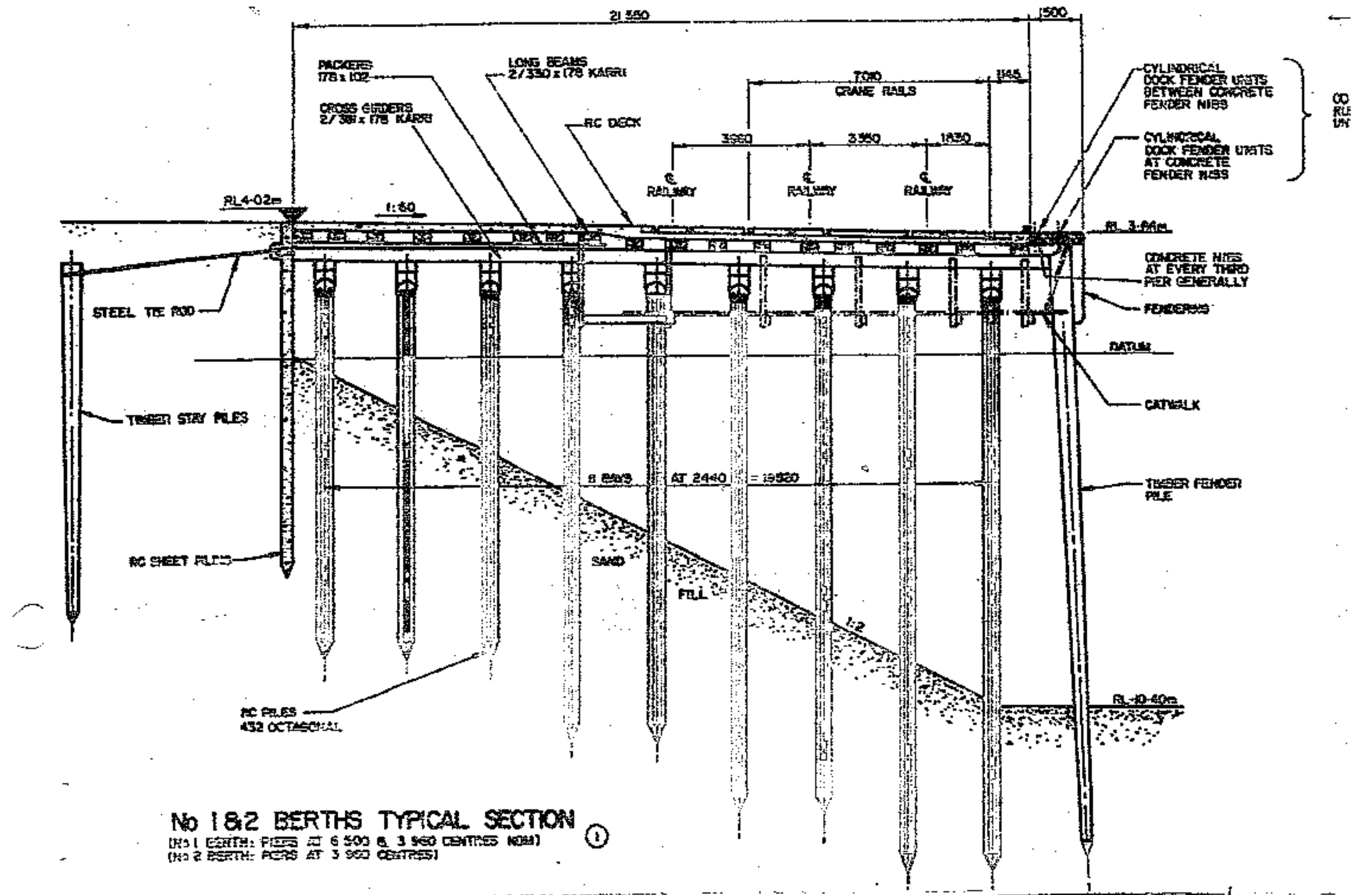
The wharf structure of the No 3 berth consisted of a reinforced concrete slab deck supported on longitudinal steel beams. The longitudinal steel beams were supported on transverse steel cross girders fixed to steel tubular piles. The berth, which was 227m in length, was constructed in 1970 and was used for general bulk and grain loading.



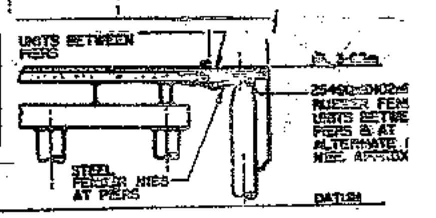
Rear of Albany No1 Berth transit shed with rising grain conveyor to No 3 Berth in background – February 1988

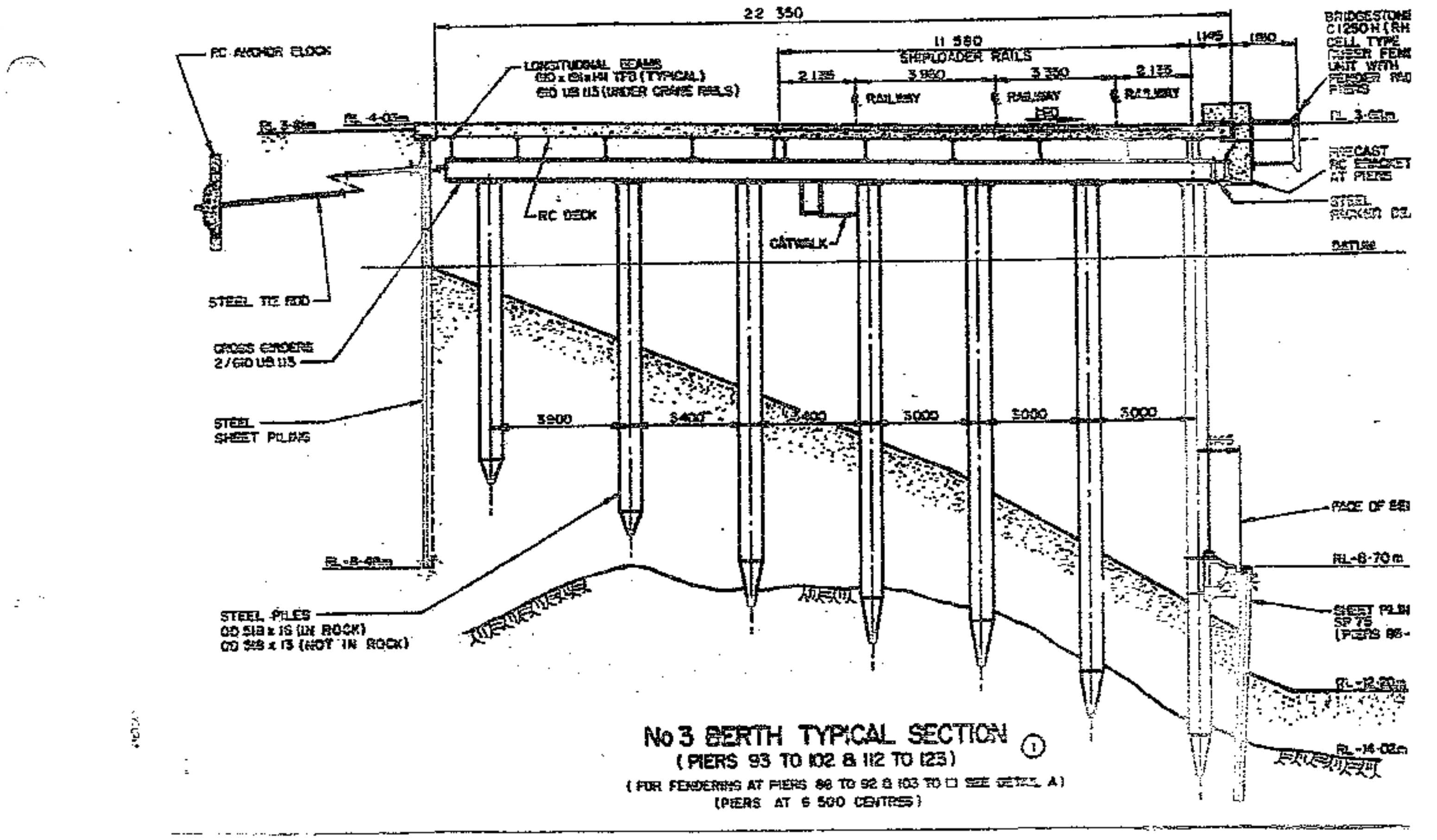


Modified fender system to Albany No 3 Berth using Bridgestone cell type rubber fender units, allowing for a berthing load of a 60,000 tonne loaded displacement vessel. No 3 Berth was constructed in 1970 and upgraded in 1979 to take deeper draft vessels. - 17th February 1988.



PORT OF ALBANY
CROSS SECTIOMS OF BERTHS 1, 2 AND 3





Albany Emu Point Small Boat Facilities 2007 *google earth*

47 Albany Emu Point

Fishing Industry Facilities

Between 1964 and 1967 100,000 c.yds of material was dredged from Oyster Harbour, Albany by the department's 8" cutter suction dredge PW8 for the basin and approach channel for the new fishing boat harbour at Emu Point, together with the construction of pens and a concrete service jetty,

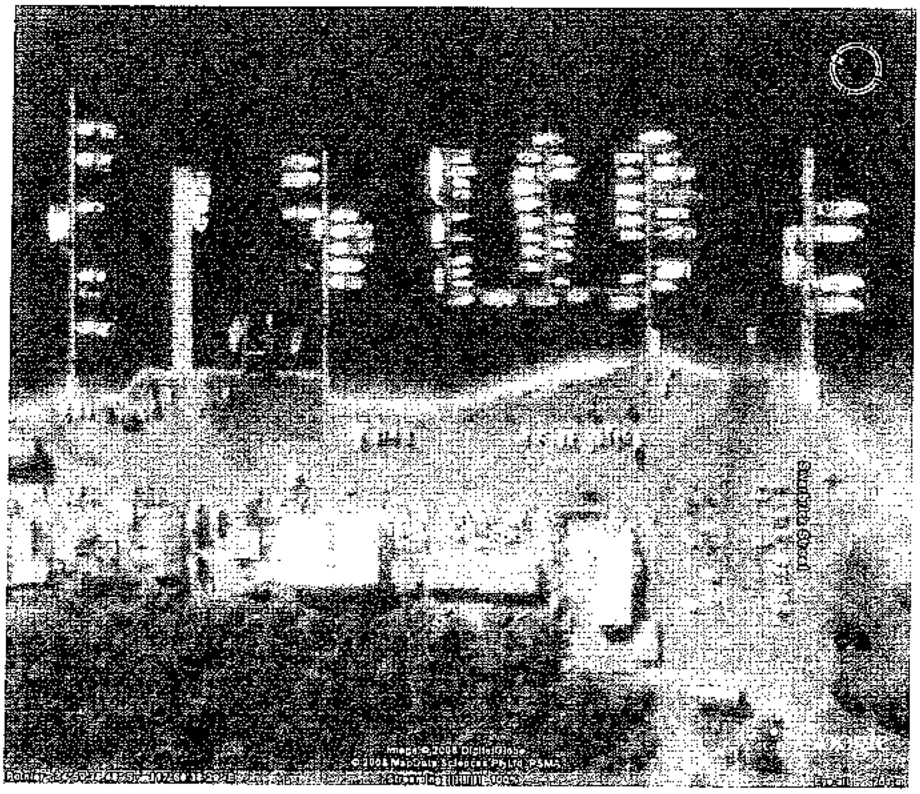
Other dredging was carried out in the King, Frankland and Deep Rivers for navigational purposes. .

Dredging was also carried out for the Princess Royal Yacht Club and the Ski Club in Princess Royal Harbour,

In 1971 further dredging was carried out by dredge PW8 at Emu Point including the dredging of a swimming pool, followed by the dredging of navigation channels in the Frankland River,

A new jetty for the fishing industry was built at Emu Point in 1978/79. Provision for facilities for large trawlers was being investigated.

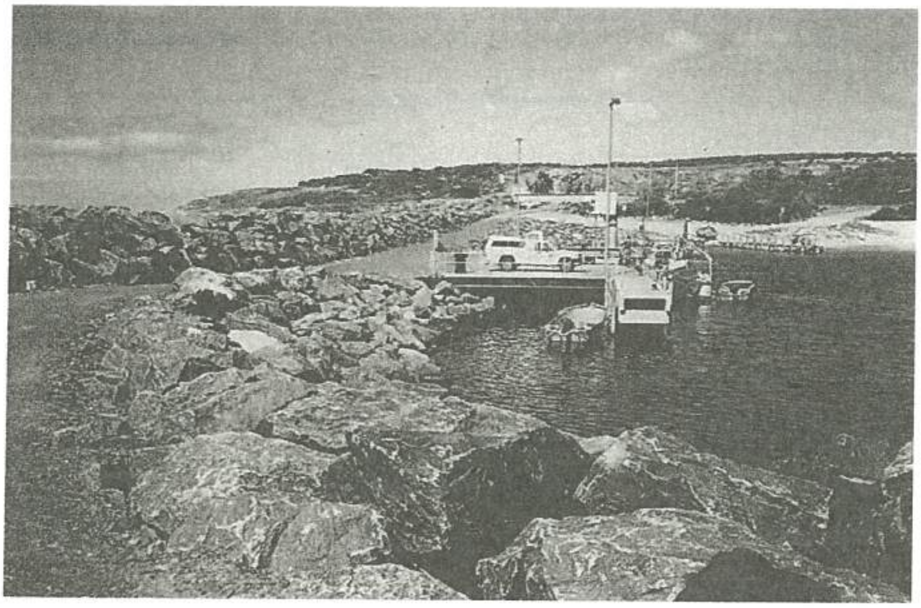
In 1984 a low level landing was constructed at the service Jetty at Emu Point.



Albany Emu Point Small Boat Harbour 2008 *google earth*

48 Bremer Bay

A facility for small boats was provided at Bremer Bay in the late 1980s



Above - A view of the new Bremer Bay fishing boat harbour looking from the end of the breakwater towards the shore. The harbour consists of large granite rock breakwater, providing a protective water area and a land backed service wharf with an electric crane for loading stores and unloading fish. A double lane launching ramp is located off the beach to the right of the breakwater.
Below - A rather elaborate "multi Z-bend" walkway leading from the high ground above the harbour down onto the beach near the launching ramps.

Hopetoun Small Boat Marine Facilities 2007

google earth

49 Hopetoun

Early History

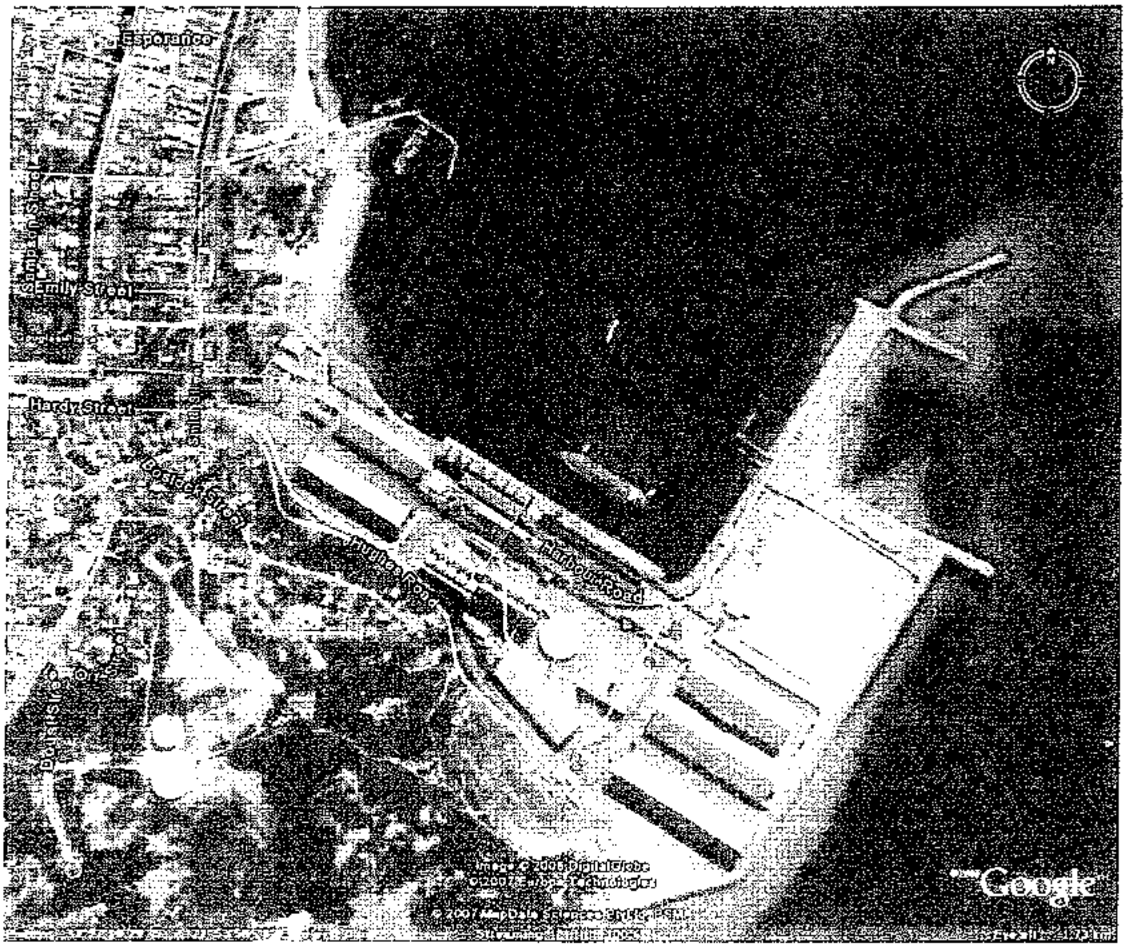
The first jetty built at Hopetoun was in 1901 when mining equipment for the Floater Mine was unloaded. In 1902 this was extended to 600 feet. IN 1907 it was extended to 1, 46 feet. In 1960 the port had a 1,350 feet length with 14 feet of water at its head. In 1938 the control of the jetty was passed over to the local authority and as closed to the public in 1944

Development 1980s

Between 1982 and 1985 the construction of a new fishing boat harbour facility at Hopetoun was completed including a breakwater with reclaimed hardstanding and service areas, a boat landing and a boat ramp

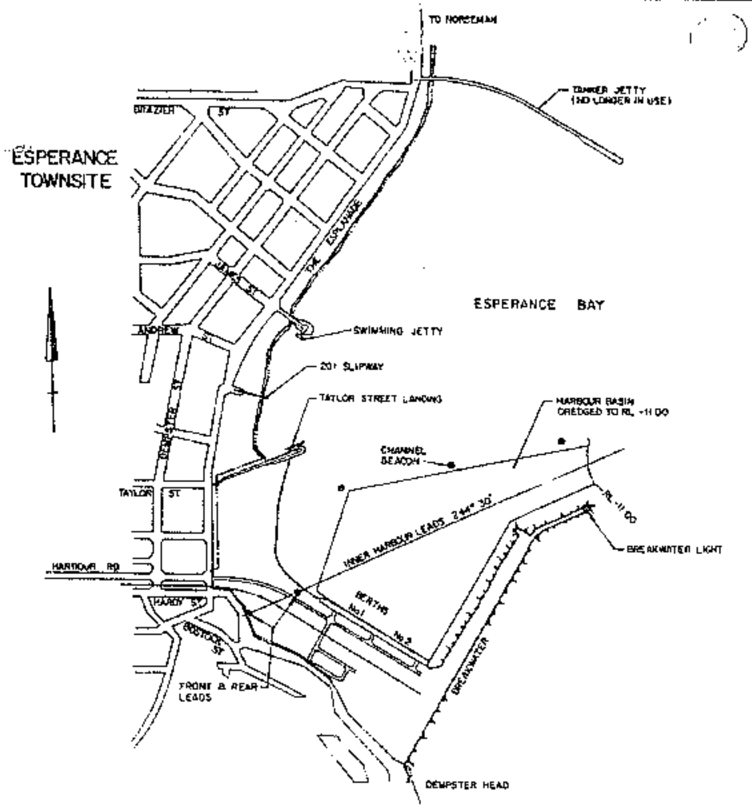
In 1984/85 the remaining sections of the old timber jetty were demolished.

Marine facilities for small craft at Hopetoun

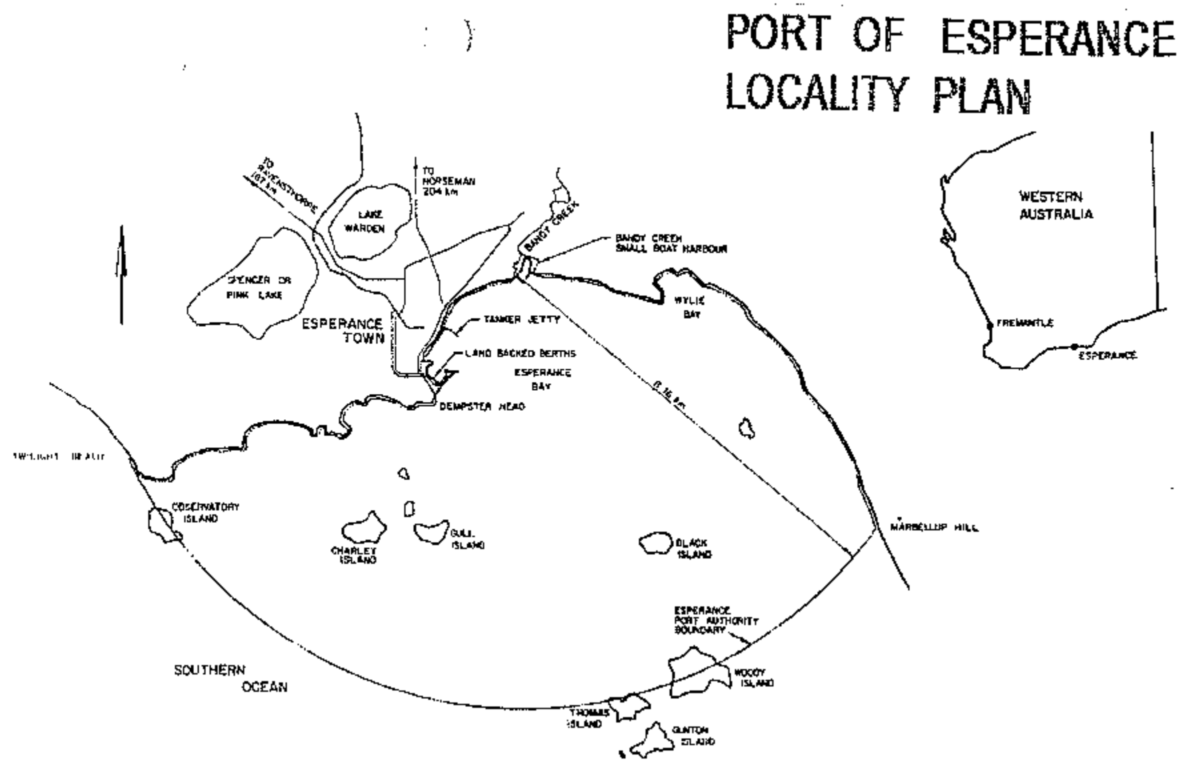


The Port of Esperance 2007 *google earth*

PORT OF ESPERANCE LOCALITY PLAN



PLAN ①



PORT BOUNDARY LIMIT ②

PORT INFORMATION

POSITION
LAT 33°52' S , LONG 121°54' E

DATUM
ZERO ON THE TIDE GAUGE WHICH IS 0·707m BELOW AHD

ACCOMMODATION
WELL DEFINED APPROACH IN ESPERANCE BAY, THROUGH ENTRANCE CHANNEL LEADS INTO BREAKWATER PROTECTED LAND BACKED BERTHS. No1&2 LAND BACKED BERTHS HAVE A BERTHING LENGTH OF 457m WITH THE MINIMUM DEPTH ALONGSIDE AT 11·0m. THE TIDE RISE IS 0·76m. GOODS SHED, BONDED STORE, WHEAT SILOS AND ORE STORAGE SHEDS ARE LOCATED NEAR THE BERTHS.

IMPORTS
GENERAL CARGO AND PETROLEUM PRODUCTS

EXPORTS
WHEAT, BARLEY, SALT, NICKEL CONCENTRATES, MAGNESITE AND LIVESTOCK.

CARGO HANDLING
BY SHIP'S GEAR AND TWO LINK BELT LOADERS

RAIL SERVICES
STANDARD GAUGE RAIL CONNECTION FROM WHARF AREA TO NATIONAL RAIL SYSTEM.

FRESH WATER
AVAILABLE FROM ALL BERTHS

OIL SERVICE POINTS
THE BUNKERING OF SHIPS AND THE DISCHARGE OF REFINED PETROLEUM PRODUCTS IS FROM No 2 BERTH

ELECTRICAL SERVICES
FLOODLIGHTING IS PROVIDED ON THE TWO LAND BACKED BERTHS. THE 20 TONNE SLIPWAY HAS GENERAL LIGHTING ONLY. 30A 3 PHASE 440V 50Hz OUTLETS ARE PROVIDED ON THE 20 TONNE SLIPWAY. 150A 3 PHASE 440V 50Hz OUTLETS ARE PROVIDED ON THE TWO LAND BACKED BERTHS. BOTH THE 20 TONNE SLIPWAY AND THE TWO LAND BACKED BERTHS ARE PROVIDED WITH 15A SINGLE PHASE 250V 50Hz OUTLETS

ROAD SERVICES
THE LAND BACKED BERTHS ARE CONNECTED WITH THE STATE ROAD NETWORK.

PORT OPERATING AUTHORITY
ESPERANCE PORT AUTHORITY

TIDE DATA
AN AUTOMATIC TIDE RECORDER IS INSTALLED. PREDICTIONS ARE AVAILABLE

PILOTAGE
PILOTAGE COMPULSORY BY ARRANGEMENT WITH RESIDENT HARBOUR MASTER

METEOROLOGICAL DATA
RELATING TO THIS AREA MAY BE OBTAINED FROM THE AUSTRALIAN BUREAU OF METEOROLOGY PUBLICATION - "CLIMATIC SURVEY" - ESPERANCE - REGION 5 - WESTERN AUSTRALIA

REFERENCE PLANS

	PWD., WA
BERTHS	
No 1	40666, 42800
No 2	40810
SOUNDINGS - (1977 ONWARDS)	50499
BREAKWATER	39583, 47821
TAYLOR STREET LANDING	48965
20t SLIPWAY	47297
JAMES STREET JETTY & GROYNE	51443, 51875
HYDROGRAPHIC SURVEY - 1981	53461
PORT BOUNDARY & LEASES	46365, 51363
BANDY CREEK BOAT HARBOUR	55130, 51639
NAVIGATION AIDS	41725
ADMIRALTY CHARTS	AUS 119, BA 1059

SCALE OF METRES ① (1:20000)
SCALE OF METRES ② (1:200 000)

GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN METRES
1. SEE DRG 55923-11-2 FOR LEASES
2. SEE DRG 55923-11-3 FOR CROSS SECTIONS & DESIGN LOADINGS

SCALES AS SHOWN
MICROFILMED
DATUM
AS SHOWN

DESIGN CALC — BOOK
CHECKED — BOOK
DRAWN PJS — CHECKED CS/JHG
TRACED — CHECKED
SUPERVISING DESIGN ENGINEER HBR
SUBMITTED — DATE 29 10 83
APPROVED — DATE 24-1-84

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF ESPERANCE
LOCALITY PLAN AND SERVICES DATA

PW 57003-1

ZONE	DATE	REVISION	DR	APPD

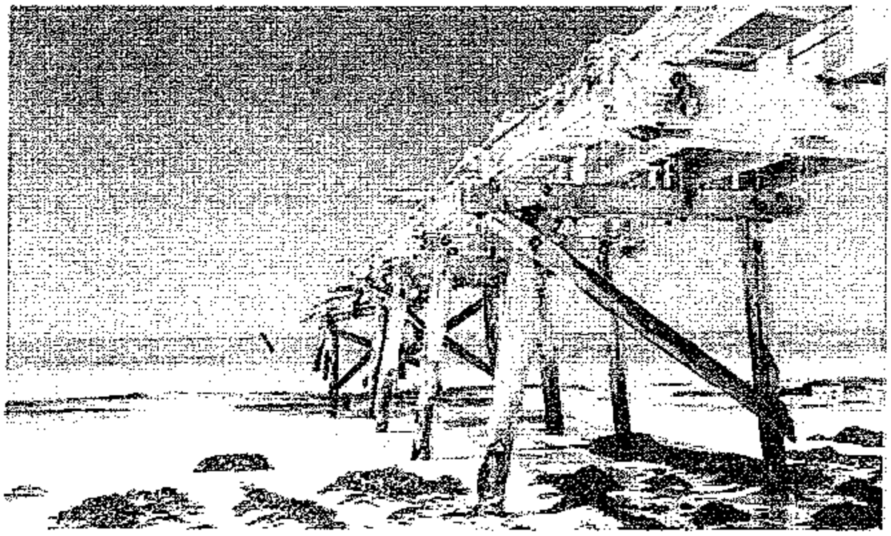
SURVEY BOOKS — FILE No PW 1248/53

50 Esperance

Early History

As the result of waling and sealing activities between Esperance and Eucla as early as 1838 and the building of the East West Telegraph line in 1875, several landing places developed along the south coast with jetties being built at Eucla and Israelite Bay.

Telegraph Stations were established at Bremer Bay, Esperance, Israelite Bay, Eyre and Eucla with the repeater station at Israelite Bay operating until 1917.



The remains of the Eucla Jetty - source unknown

Following the discovery of gold in Coolgardie in 1892 and in Kalgoorlie and Norseman in the following year Esperance was gazetted a township in 1893. A 340 feet length jetty was built in 1894 followed by a bond store and goods shed in 1895. In 1897 the Town Jetty was lengthened to2810 feet with 18feet of water at the head. A second jetty was built shortly after at Castletown, a mile or so north of the Town Jetty by the Esperance Bay Land Company, with 23 feet of water at the head

In 1933 to 1935 a third timber jetty was built at the northern end of the town The jetty which became known as that tanker Jetty was 2,190 feet in length with a 557 feet by 48 feet wide. The resident engineer for this project was John Gillespie, and the Engineer for Harbours and Rivers was J Stevenson Young.

Harbour Development 1960 – 1985

In July 1962 a contract was awarded to the Barbarich Construction Company for the construction of a 3,425 feet length breakwater at Dempster Head, After completing 80% of the contract the contractor ran into financial difficulties with work ceasing in March 1964. A second contract was then awarded to The Esperance Breakwater Company with the breakwater being completed in late 1965 at a total cost of 302, 000 pounds,

In September 1963 a contract was awarded to Dredging Industries (Aust) Pty Ltd for the sum of 396,666 pounds for the removal of 2.5 million cubic yards of sand from the entrance channel and inner basin. The contract was completed in 1965.

In December 1963 a contract was let to John Holland Construction Pty Ltd for the construction of a 634 feet length land backed berth. for the sum of 414,110 pounds with the work being completed in 1965,

The total cost of the new harbour which was 1,337,000 pounds was opened by Premier David Brand on 19th November 1965.

The resident engineer in the 1960s port development was Adrian Urquhart.

In the late 1960s fishing craft facilities were provided along the foreshore between James and Taylor Streets, A Jetty was built near Taylor Street and a slipway /launching ramp was built just south of James Street.

Stabilization of the foreshore, reclaimed by dredging was completed and handed over to the Esperamce Shire. A contract was let to Hunter and Lewis Pty Ltd for the construction of a 350 feet length rock groyne to protect the foreshore area in the vicinity of the western boundary of the Port Area.

The construction of a 750 feet length sheet pile wall behind the site of the second land backed berth was completed in 1970/71 by the day labour organisation of the Harbours and Rivers Branch of the Public Works Department.

Major rebuilding of the seaward end of the Tanker Jetty, damaged during the berthing of a tanker in March 1970 was completed. The end section of the disused old town Jetty was demolished.

A contract for the construction of a 700 feet length second land backed berth extending eastwards from the No I Berth and on the same alignment was awarded to John Holland Constructions Pty. Ltd. on November 19th 1970 for the sun of $1,073,743 for completion in February 1972.

.The 700 feet length berth was completed by John Holland Constructions Pty, Ltd. in April 1972 and ancillary work as hard standing, lighting etc.

was completed in June 1972. The new berth was officially opened by the Hon. John Tonkin, Premier of Western Australia on May 5 1972.

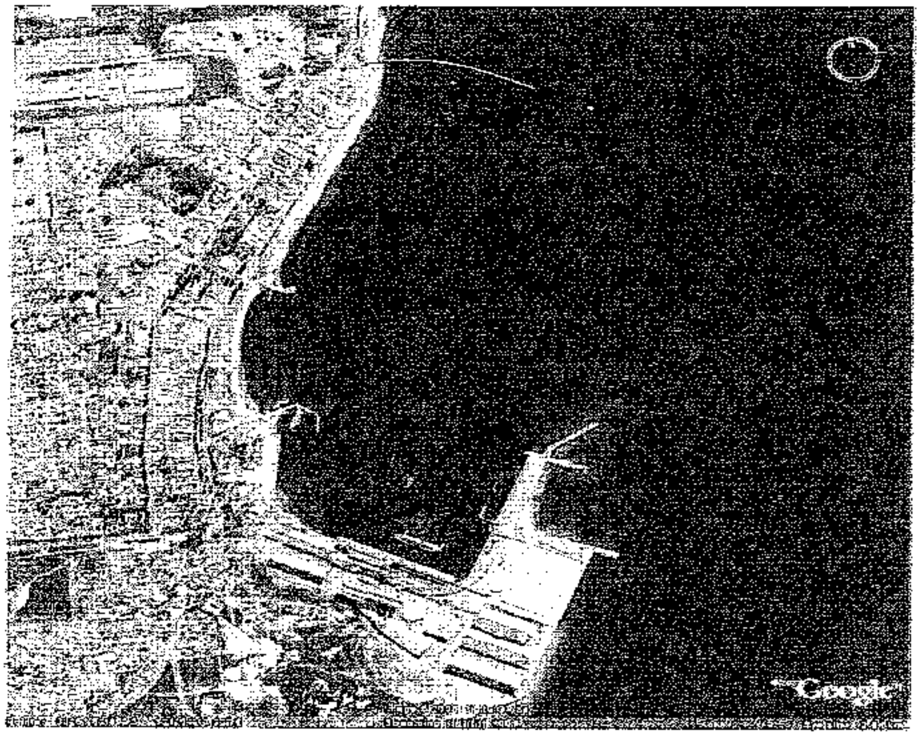
The contract for a 350 feet long groyne, awarded to Hunter and Lewis was completed during the year. .

In 1972/73 a contract was completed for a 210 feet extension of the foreshore training wall. No 1 Berth fender system was modified, and a 20 ton capacity small slipway and a launching ramp on the foreshore Just south of the existing town jetty were completed.

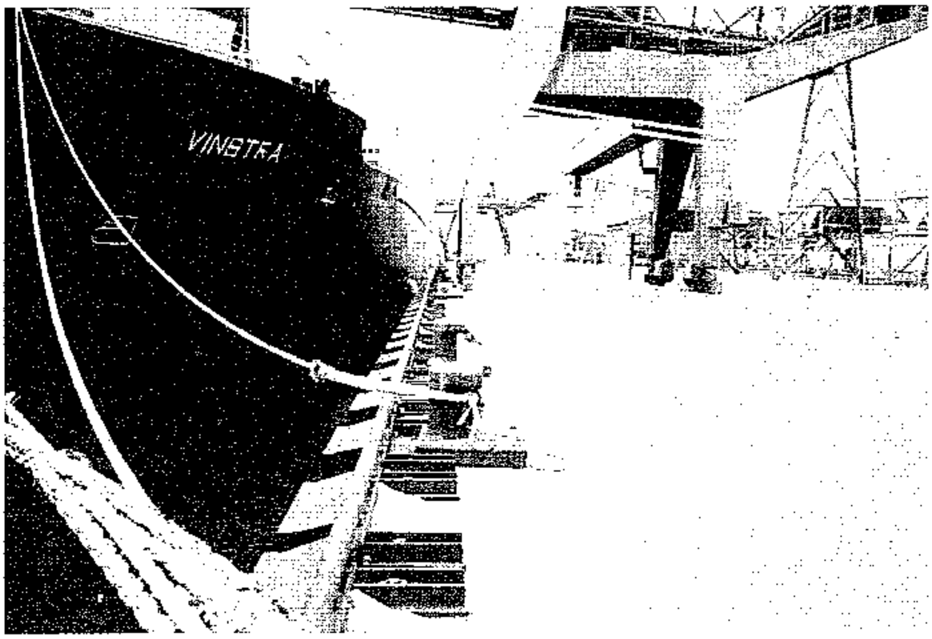
The resident engineer in the 1970s port development was Bill Andrew who also covered the development at Albany

Due to the inability of Franco Constructions to complete its contract for the extension of the existing breakwater by 650 feet, tenders were recall-ed, the tender being awarded to A Firns, who completed the work in 1973..

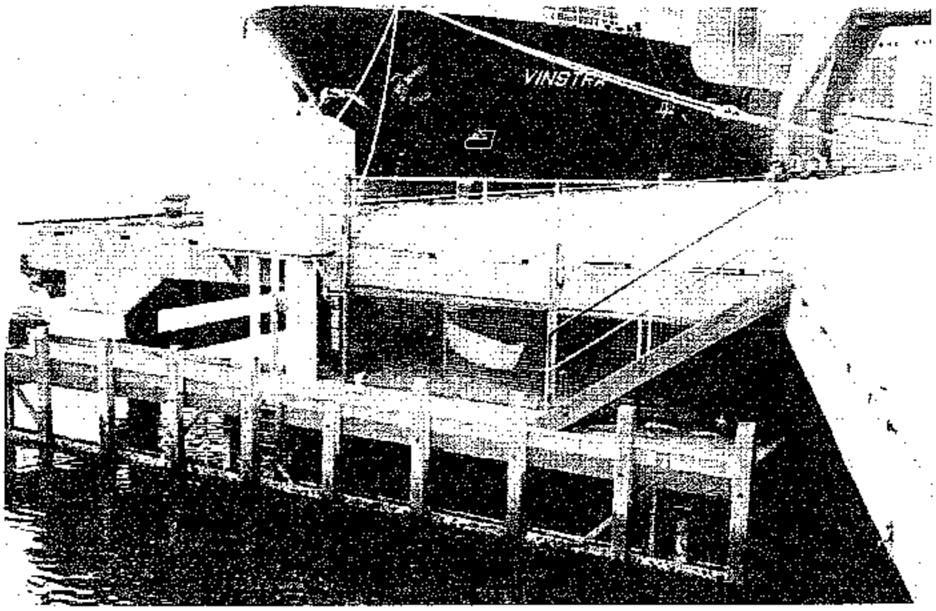
Between 1980 an 1982 the elocation of the entrance channel navigational aids was completed and the progressive replacement of piles in the tanker Jetty, in order to retain the structure as a promenade Jetty continued with the cost being shared between the Public Works Department and the Esperance Shire Council.

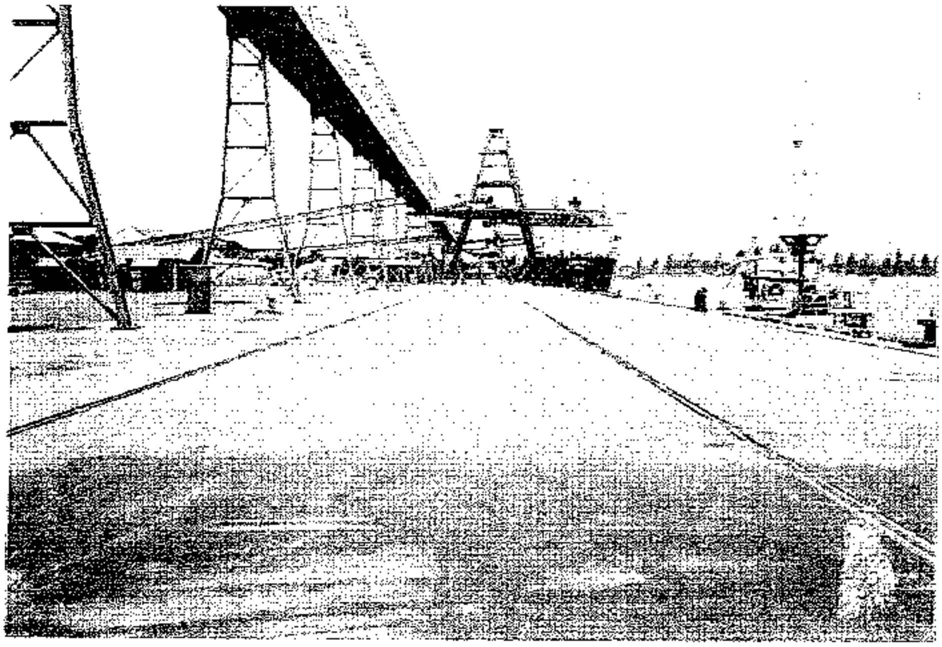


Esperance Bay with the old 1935 "tanker" jetty at top followed by the groyne and small jetty at the old town jetty site at James Street, launching ramp/ slipway (not visible), the Taylor street complex and small boat harbor and the main harbour with berths and breakwater .



Esperance Harbour - No1Berth with an overall length of 244m consisted of a 22.25 metre width reinforced concrete deck slab supported on tubular steel piles and carried a travelling ship loader owned and operated by Co-Operative Bulk Handling The berth was designed to take a deck stack loading of 3,400 kg/ m2 and a berthing load from a vessel of 30,000 tonnes loaded displacement mass with 50% of the kinetic energy being absorbed by the berth. Above is a general view of the berth and the photograph below taken of the end of the berth shows a typical type cross section of the structure.





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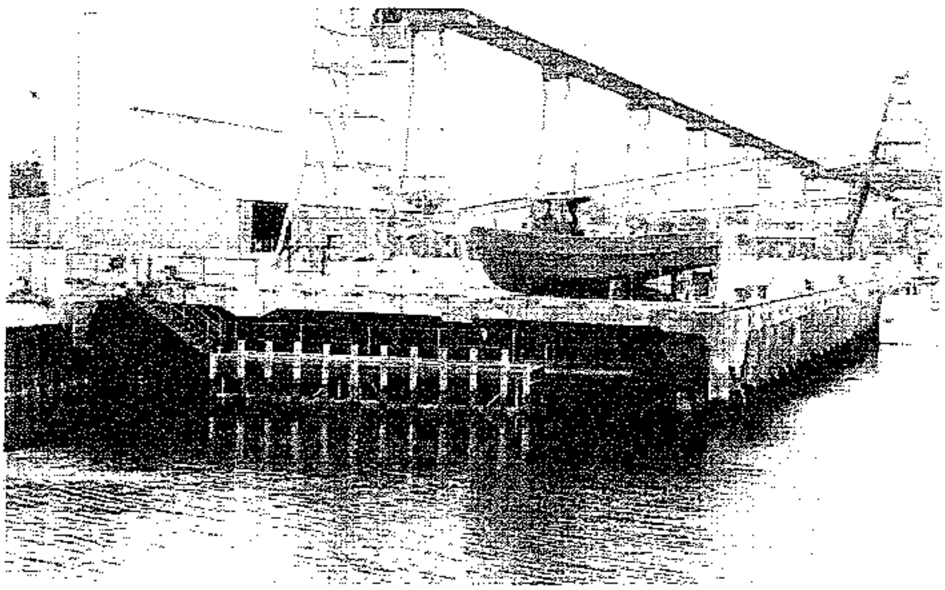
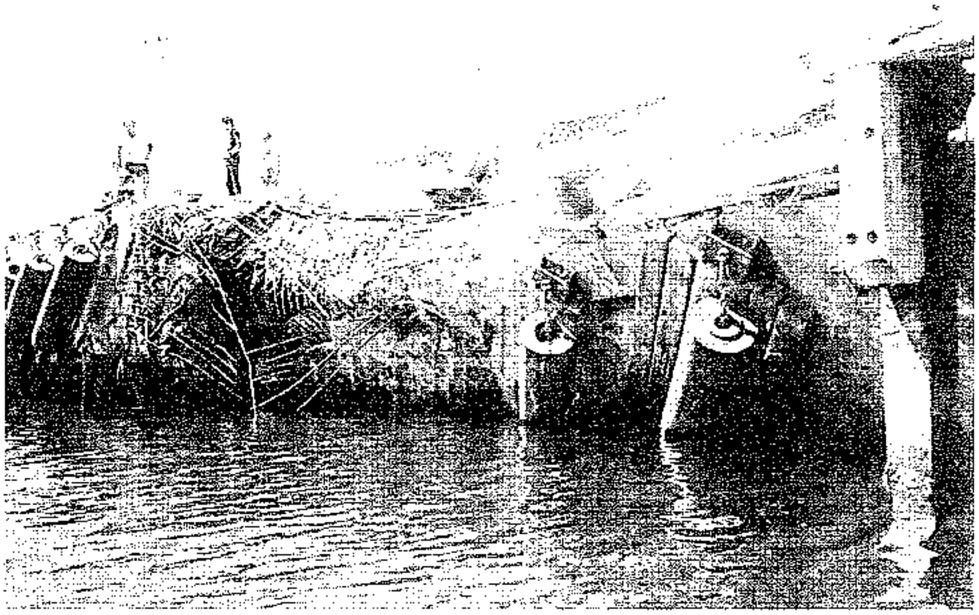
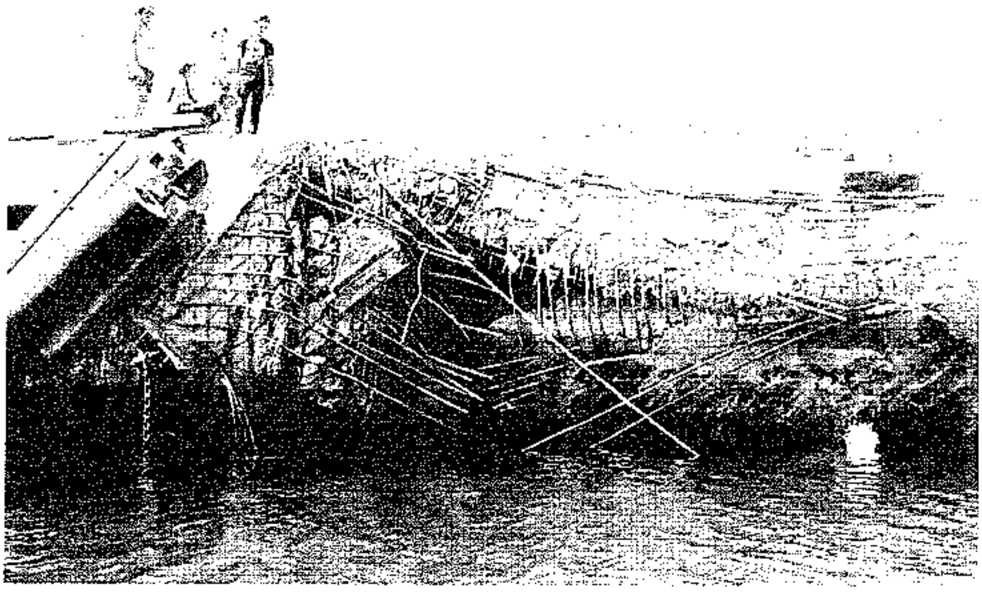
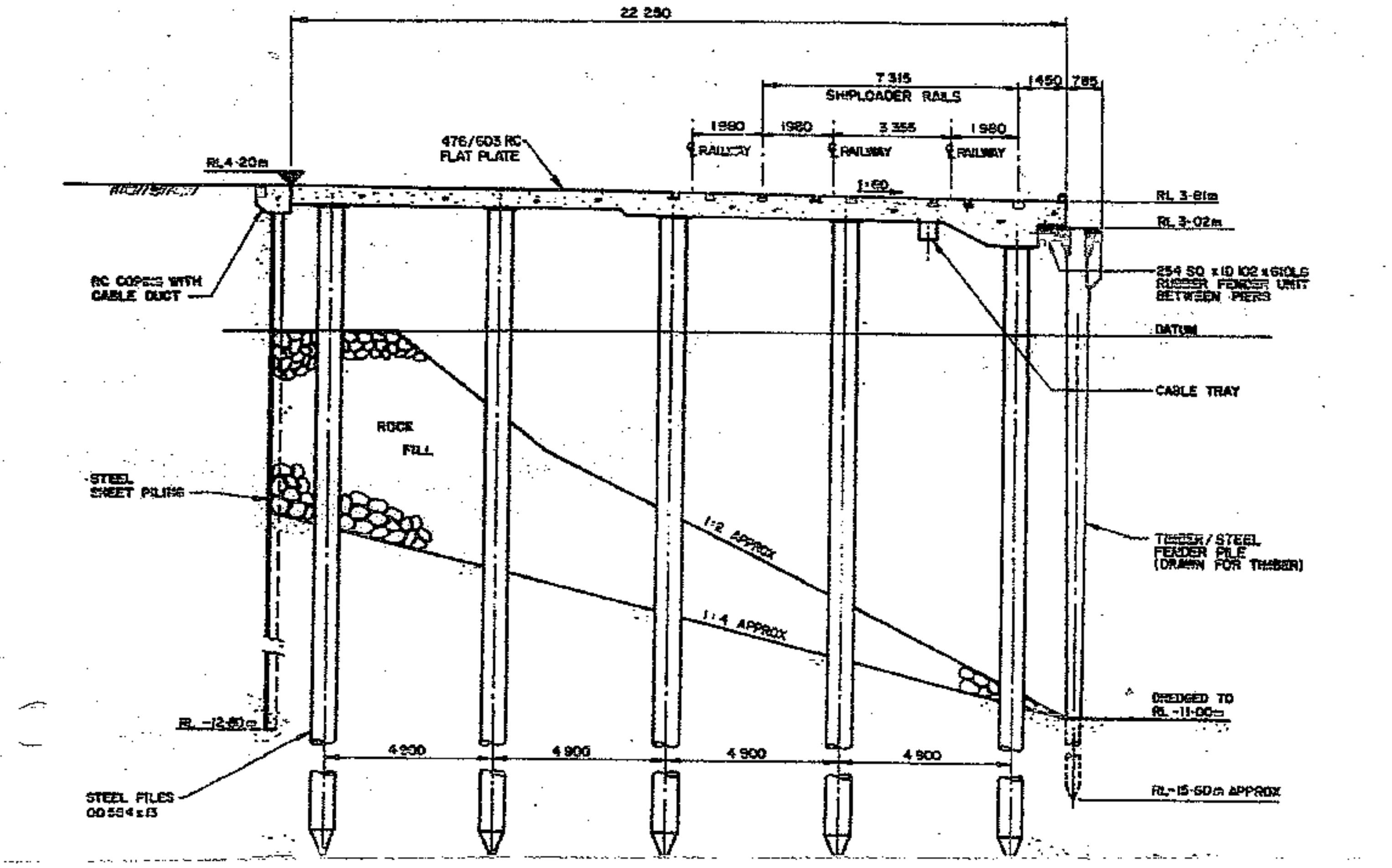


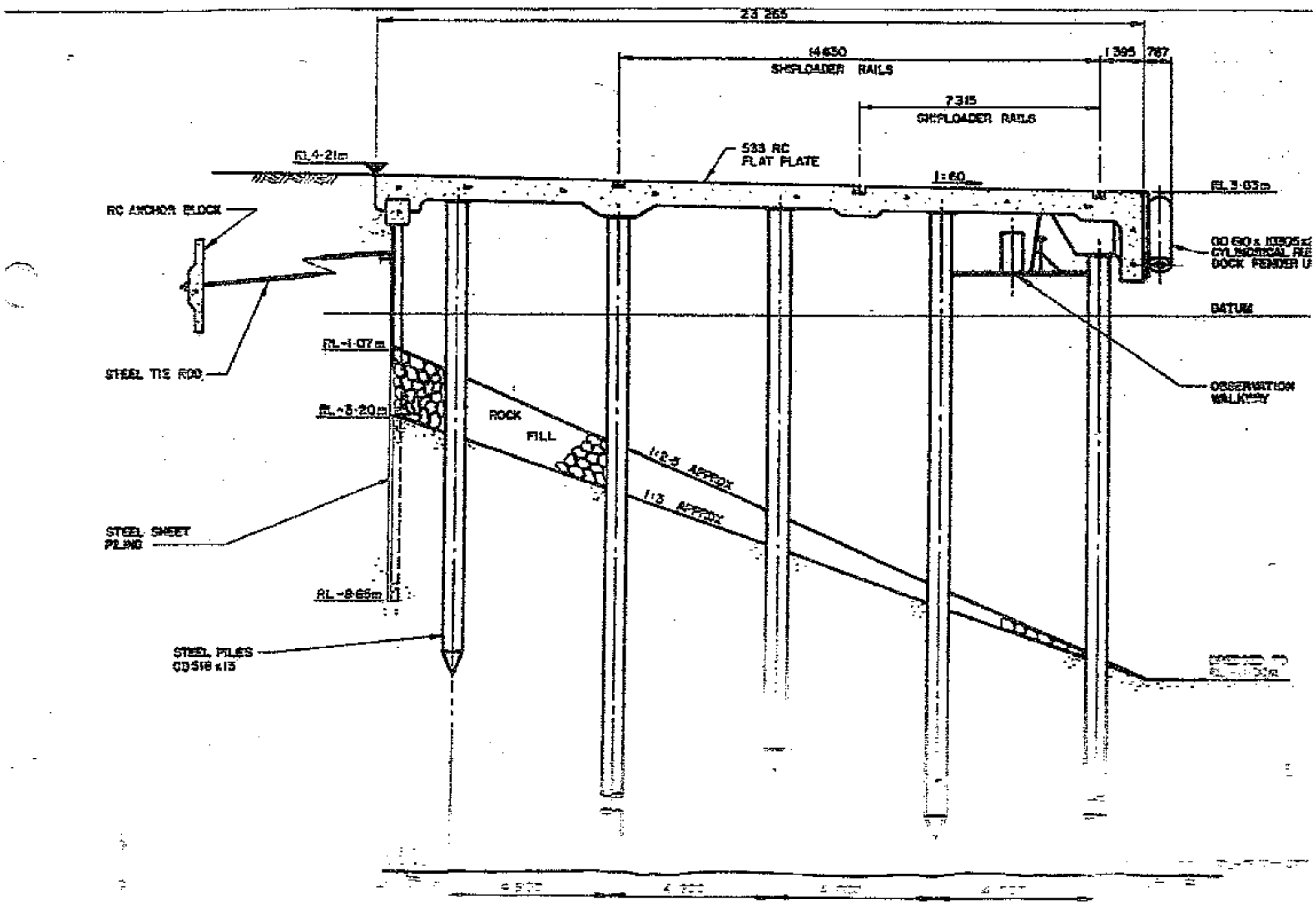


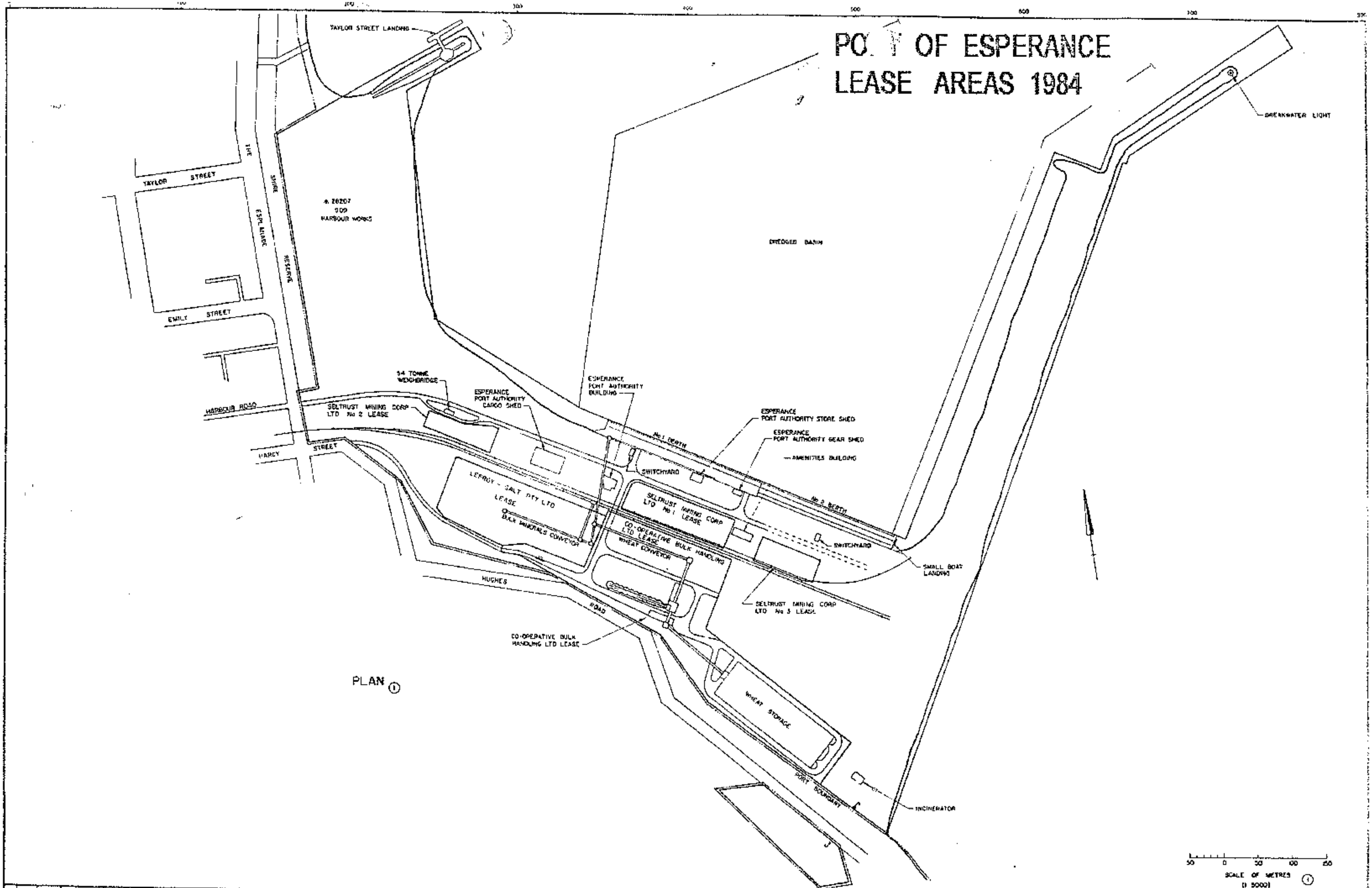
Damage caused as a result of a collision between the tanker "Australian Spirit" and Esperance No 2 Berth between piers 49 and 52 on 9th December 1987. Photograph taken on 21st January 1988 showing the point of impact and the collapsed fender apron. The end of No1 berth which was not damaged in the incident is on the RHS of the above photograph.





PORT OF ESPERANCE
CROSS SECTIONS OF BERTHS 1 AND 2





GENERAL NOTES
UNLESS OTHERWISE SHOWN ALL DIMENSIONS ARE IN
1. SEE DRG 53923-11-1 FOR LOCALITY PLAN

ZONE	DATE	REVISION	DR	APPD
SURVEY BOOKS			FILE No	PW 1248/65

SCALES AS SHOWN
MICROFILMED
DATUM
ZERO ON THE TIDE GAUGE WHICH IS 0.737m BELOW AHD

DESIGN CALC — BOOK
CHECKED — BOOK
DRAWN PJS — CHECKED CS/JHS
TRACED — CHECKED
SUPERVISING DESIGN ENGINEER HBR
SUBMITTED — DATE 22 11 83
APPROVED — DATE

PUBLIC WORKS DEPARTMENT — WESTERN AUSTRALIA
REGIONAL PORTS OF WESTERN AUSTRALIA
PORT OF ESPERANCE
LEASES

57923-11-2

Esperance Fishing Boat Harbour Bandy Creek

2007

google earth

51 Esperance Bandy Creek

Fishing Boat Harbour

A site at the mouth of Bandy Greek was selected in 1979 for the new fishing boat harbour, following which an access road to the site of the Bandy Creek Boat Harbour and a bridge over Bandy Creek were constructed.

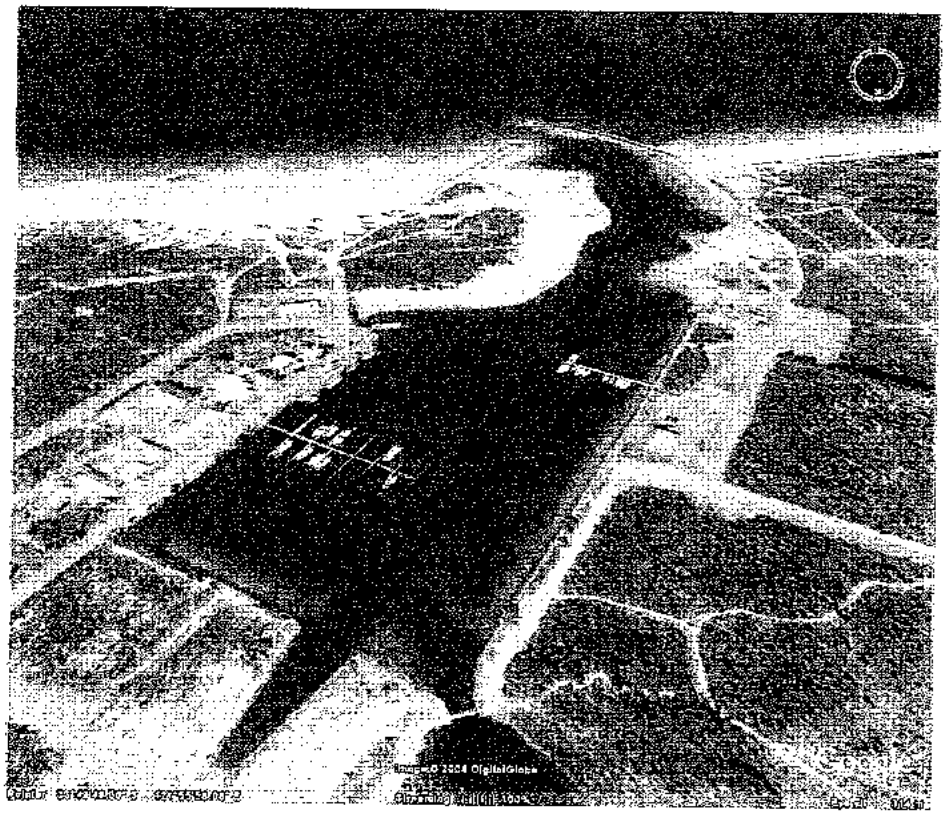
By mid 1982 the two breakwaters at the entrance to Bandy Creek and the access road to the east side of the site had been completed

The main harbour basin was excavated by land based plant using de-watering techniques The entrance to the harbour was dredged by conventional dredging. A new boat launching ramp, land backed wharf and boat pens were completed at the end of 1983.

The harbour was officially opened by Premier Burke on 6th November 1983.

The first stage of the mooring pens to take 40 vessels was completed early in 1984/

A landing on the Taylor Street Jetty in Esperance was completed in 1979 and an electric hoist was installed the following year,



Appendices

Appendix 01
The Harbours and Rivers Branch 1896

From the inception of the Swan River Colony in 1829 works were carried out under the supervision of Henry Reveley, the Colony's first Civil Engineer and Superintendent of Public Works. Public Works covered government buildings, roads and bridges, water supplies, jetties and other marine facilities and later railways. A separate section was later formed for the development of the Port of Fremantle under Fremantle Harbour Works. It was not until 1896 that the Department was organized into several separate branches, On July 1st 1896 the branches and their heads were as shown below:

GENERAL DIVISION	
Under Secretary for Public~ Works	M.E. Jull
ENGINEERING DIVISION	
Engineer-in-Chief	C.Y. O'Connor
Engineer in charge of Roads and Bridges, Harbours and Rivers, Sewerage and Water Supply	T.C. Hodgson
Architectural Division, Assistant Engineer-in-Chief	G.T. Poole
Engineer-in-Charge of Railway Construction	Jas Thompson
Engineer-in-Charge, Goldfields Water Supply	M. Hector
Engineer-in-Charge, Fremantle Harbor Works	J.A.McDonald
Inspector of Surveys, Engineering Surveys Branch	John Muir
Stores Accountant, Stores Manager's Branch	J.H. Rogers
Consulting Engineer, London	J. Carruthers

In 1902 C.S.R. Palmer was appointed as Engineer in Chief to succeed O'Connor. With the completion of the major works at Fremantle the separate branch of Fremantle Harbour Works was absorbed into the Harbours and Rivers Branch, with A.W. Dillon Bell being appointed as Engineer in Charge, Harbours and Rivers. A separate Water Supply and Sewerage Branch was headed by Hugh Oldham and the Coolgardie Water Supply Branch by W.C Reynoldson."

With the reorganisation of the Public Works Department in 1985 the Harbours and Rivers branch was dissolved after nearly 90 years, with Max Anderson being the last Engineer, Harbours and Rivers.

Appendix 02
Public Works Department
Engineering Division
Organisation 1980

In 1980 the Engineering Division of the Public Works Department controlled all Government irrigation and land drainage schemes throughout the State, with the exception of metropolitan main drains, and all water supply and sewerage schemes with the exception of the Perth Metropolitan Area and a small number of country towns where water boards, local authorities or private mining companies are the controlling authorities. The Engineering Division was also responsible for all marine works in harbours and estuaries controlled by the Government. It was also responsible for advising on engineering development work undertaken by Port Authorities throughout the State excluding the Ports of Fremantle and Port Hedland.

The Engineering Division consisted then of seven separate Branches which were responsible through an Executive Section to the Director of Engineering.

The two **Operations Branches** were responsible (each within its own section of the State) for all the operation and maintenance activities associated with public utilities and services which were undertaken by the Engineering Division. Except in respect of large and/or complex projects, the two Operations Branches were responsible for all construction work, either by day labour or contract, carried out by the Engineering Division., excluding major marine construction.

The **Programming and Special Projects Branch** was responsible for the preparation of both short and long term programmes for the Engineering Division and for the preparation of submissions for projects requiring special endorsement or assistance from sources outside the State Government. It undertook special projects and provided specialist advice on irrigation, drainage and sewerage works.

The **Harbours and Rivers Branch** was the specialist on all harbour and marine activities. It was responsible for the investigation, planning and basic design of all harbour and marine projects, and was also responsible for major marine construction. The Harbours and Rivers Branch developed procedures and programmes for the maintenance by Operations Branches of all marine facilities which were the responsibility of the Engineering Division, and it provided advice and assistance either directly or through consultants on all aspects of port development and maintenance to various Port Authorities with the exception of Fremantle and Port Hedland. The Branch investigated erosion problems and prepared plans for the effective management of the State's coastline and estuaries. It was responsible for the management of the Fremantle Slipway.

The **Planning, Design and Investigation Branch** was responsible for the assessment of the State's water resources and for general hydrological studies. It planned, investigated and prepared basic designs for water supply and major irrigation projects and the full design of major hydraulic structures. It undertook all water drilling activities for which the Engineering Division was responsible throughout the State. It undertook materials testing and hydraulic model studies, and managed the Engineering Research Station at Floreat Park.

The **Mechanical and Electrical Branch** was responsible for the management of the Plant Suspense Account, the procurement and maintenance of plant, equipment and motor vehicles and the purchase of spare parts for plant and motor vehicles. It operated plant workshops and provided a materials and corrosion engineering service. The Branch was responsible for the design and installation of all mechanical and electrical equipment on projects undertaken by the Engineering Division. It controlled the purchase by contract of valves, water meters and steel pipes required by the Division. The Mechanical and Electrical Branch was responsible for the management and technical control of the State Engineering Works and East Perth Workshop and for the staffing and technical control of all other workshops operated by the Engineering Division throughout the State. It was responsible for the recruitment of all engineering trade apprentices for the Division.

The **Engineering Design Branch** was responsible for the detailed design and for the preparation of plans and specifications for water supplies, sewerage, irrigation, drainage and harbour works throughout the State, as required by the Engineering Division. It was responsible for the printing, recording and safe custody of Engineering and Architectural plans, documents and field records."

Appendix 03
Harbours and Rivers Branch
Organisation 1980

The Chief Officer of the Harbours and Rivers Branch was the Chief Engineer, Harbours and Rivers (previously Engineer for Harbours and Rivers) who was directly responsible to the Director of Engineering, Engineering Division, Public Works Department.

Under the Chief Engineer, Harbours and Rivers was his Principal Assistant Engineer who oversaw three Senior Engineers each in charge of a section in the branch

The Senior Engineer Construction who through engineers based at Fremantle Harbour Works and other areas in the State supervised all marine construction and maintenance works, by day labour and contract,

The Senior Engineer Planning who was responsible for the advance planning of all works, recommending to the investigation section the surveys and field work to be carried out prior to the preparation of plans and the fixing of design criteria and parameters.

The Senior Engineer Investigations was responsible for all coastal, estuarine and ocean investigations and covered hydrographic surveys, wave recording, tidal information and ground testing and the testing of materials used in construction. This section of the Branch operated from offices, stores and workshops in Ellan Street in Victoria Park

All three Senior Engineers had to work closely together as there was a certain amount of overlap between their respective duties.

Resident Engineers were either based solely at a port to look after all engineering matters in the port or were allocated to a particular constriction project or else depending on the size of the project or did both,

Fremantle Harbour Works as the remnant of the name when is a part of the Fremantle Harbour Trust (Fremantle Port authority) was the "back bone: of the Harbour and Rivers day labour construction team for the whole State in

the storing, fabricating and treating material prior to forwarding to the field,
the modifying, maintaining and storing plant
the providing of expertise in pile driving. operating floating plant, steel fabrication, surface treatment
providing materials in conjunction with Government Stores

During the life of the Harbours and Rivers Branch, many of its officers served on several inter departmental and government committees which included

Swan River Conservation Board

This committee operated under "An Act which was to make New Provision for Maintaining and Improving the Condition of the Waters and of the Foreshore of the Swan River."

Peel Inlet Advisory Committee

This committee's aim as to improve the condition of the waters and of the foreshore of the Peel Inlet and adjacent waters

Leschenault Estuary Advisory Committee

This committee's aim as to improve the condition of the waters and of the foreshore of the Leschenault Estuary and adjacent waters

Minister's Boating Advisory Committee

This committee's brief was to advise the Minister on navigational matters and safety for small craft

Foreshore Leases Committees

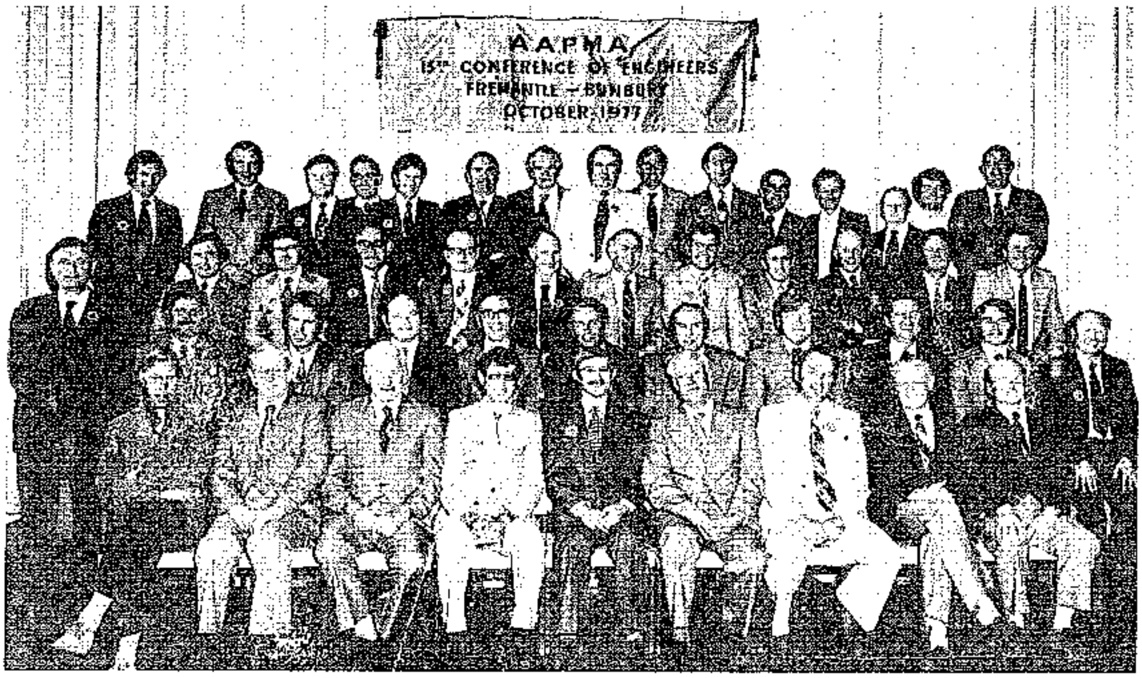
This committed acted as a "Property Manager" for all foreshore government land on lease within the Swan and Canning River and small bat harbour.

Fishing Industry Facilities Requirements Committee

This committee which was chaired by the Engineer for Harbours and Rivers was responsible for investigating the need for fishing boat facilities throughout the State and for the implementing the planning, design, funding and construction of any such facilities. Departments represented on this committee were Fisheries, Town Planning, Harbour and Lights and Treasury.

Australian Association of Port and Marine Authorities

Engineers from the Branch periodically attended Port Engineers Conferences which were alternated between States. They were not quite as fortunate as their New Zealand counterparts, who always managed to attend all the conferences held in Australia,



A.A.P.M.A. (Australian Association of Port and Marine Authorities)

13th CONFERENCE OF ENGINEERS-FREMANTLE-BUNBURY OCTOBER 1977

Back row, left to right, G. B. Page, S. M. Fisher, E. A. Senior, J. O. Powys, H. G. Evans, F. J. Buchanan, G. Slack-smith, J. F. Chappell, J. M Bryce, R. G. Tanna, A. V. Urquhart (FPA), O. C. Henshall, J. A. Jekyll, A. H. Britton.

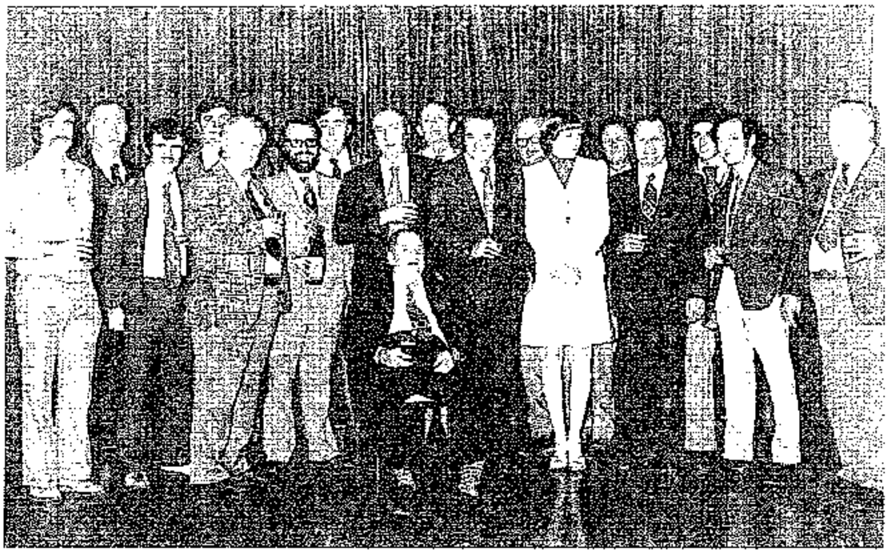
Third row, left to right *R* M. Davis, C. W. Squires, J. P. Hill, K. S. Renner, J. L. Butcher (HR), R. M. Perry, E. N. Hendy, J. Leask, J. B. Bushell, W. S. Andrew (HR), T. Baxter.

Second row. left to right R. Brokenshire, R. M. Jarvis, G. R. D. Thomson, C. L. Jordan, W. R. Dixon, P. L. Wright (FPA), M. G. Anderson (HR), R. F. Harrison, P. D. Coghlan, N. J. White, R. C. Goodwin.

Front row (seated) left to right M. B. Jacob, P. D. L. Holmes, D. Calwell, W. S. Service, J. C. Hayes, H. D. Howe, S. R. Carr, H. K. Joyce, L. B. Taylor.

Note
Most of the Australian and New Zealand Port Authorities were represented at this Conference

HR denotes engineers from Harbours and Rivers
FPA denotes engineers from Fremantle Port Authority



PUBLIC WORKD DEPARTMENT

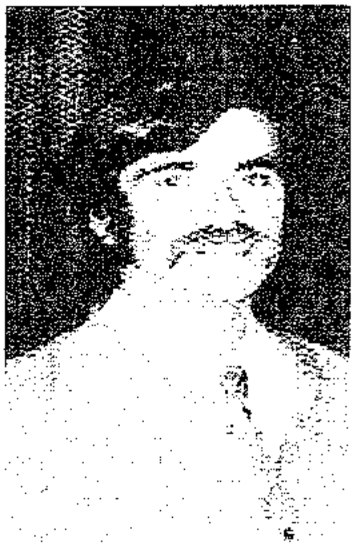
HARBOURS AND RIVERS 28th June 1976

George Bell, the Chief Clerk of the Harbours and Rivers Branch retired on 28th June 1976, exactly 50 years from when he joined the PWD as an office boy. The above photograph was taken at his retirement function held on the top floor of Dumas House, West Perth; George is seated at the front.

From left to right - Rod Banyard (engineer). Ross Dawkins (clerk in charge Fremantle Harbour Works), Bill Till (engineer), Phil Aitchison (supervisor), Mike Paul (engineer), Don Wallace (hydrographic surveyor), Max Anderson engineer), Tom Lewis (Under Secretary for Works), Clive Gordon (Manager Harbour and Light Department). Ken Kelsall (Chief Engineer PWD), our typist, Bill Andrew (engineer), Max Thorbjornsen (engineer), David Mosley (clerk), Bill Fleay (engineer).

Engineers who served in Harbours and Rivers between 1930 and 1985

Max	Anderson
Bill	Andrew
Rod	Banyard
John	Baron- Hay
Peter	Boreham
Craig	Boyce
Bob	Brindley
Jim	Brown
Jim	Butcher
John	Charnley
Byron	Cornish
Gary	Enston
Bill	Fleay
Alan	Forrest
John	Gillespie
Eddie	Gorham
Brian	Grainger
Avery	Haines
Norm	Henry
Ian	Hutton
Glen	Ketteridge
Des	Kelly
Ron	Leach
Trevor	Leaver
Keith	Lynch
Malcolm	McCleery
Cyril	Morgan
Mike	Paul
Daryl	Rapley
Mike	Rodgers
Bob	Rodgers
Ralph	Schrauf
John	Shand
Alan	Smith
Keith	Steere
Craig	Stewart
Mike	Taylor
Max	Thorbjornsen
Bill	Till
Peter	Tiurpin
Adrian	Urquhart
Andrew	Watson



Rod Banyard 1976

Rod Banyard, assistant engineer, investigations

Bill Till 1976

Bill Till assistant engineer.

Bill was seconded to the Waterway Commission as the Engineer in charge of its operations.

Phil Aitchison 1976

Phil Aitchison, Supervisor Construction and Maintenance

Mike Paul, left and Don Wallace 1976

Mike Paul, Senior Engineer Investigations – previous positions Mike held were assistant engineer at Derby and Broome, Resident Engineer at Port Hedland Harbour Works and Resident Engineer Esperance Harbour Works.

Don Wallace, Senior Hydrographic Surveyor

Max Anderson, left and Tom Lewis 1976

Tom Lewis, Under Secretary Public Works Department and Chairman Fremantle Port Authority. Max Anderson, Chief Engineer, Harbours and Rivers – previous positions held Principal Assistant Engineer, Senior Engineer and Resident Engineer Derby and Bunbury Harbour Works

Max Anderson left and Trevor Leaver, Senior Engineer Construction Previous positions Trevor held were assistant engineer at Albany and Bunbury, Resident Engineer Bunbury Harbour Works and Resident Engineer Fremantle Harbour Works,

from Exmouth to Esperance

In 1980 further beach replenishment works took place at Cottesloe and Sorrento.
The rehabilitation of the foreshore around the Esperance bay continued in 1981.

In 1982 a new timber groyne with sand replenishment was completed at Qunidalup
The sand dunes at the northern side of "The Cut", on the Leschenault Estuary, were stabilised with dredging material from the channel and a new stone pitched revetment wall was constructed.
Beach stabilisation works were carried out at Sorrento with one groyne having been constructed and two more groynes scheduled for construction in late 1983. Sand replenishment is continued to control erosion and a monitoring surveys was carried out to confirm beach movements.
Beach revetment works were also carried out at the Vasse Diversion Drain and rehabilitation of the foreshore around Esperance Bay continued with sand being placed along the northern beach.

The management of the foreshore around Esperance Bay continued with sand being placed to an agreed management plan by the Shire of Esperance.

Two groynes were constructed and additional sand placed for the Sorrento beach stabilisation project in association with the Shire of Wanneroo.

Beach erosion projects were also commenced for the Shire of Mandurah at San Remo, the Shire of Gingin at Ledge Point and the Shire of Dandaragan at Cervantes. Surveys to monitor coastal erosion were continued at Esperance, Busselton, Mandurah, Sorrento and the Midland coastal shires.

Assistance was given to the America's Cup Defence Co-ordination Committee with concept plans and estimates for pen and harbour facilities required for the contenders. Priority was subsequently given to implementing the works required inside and outside the Fremantle fishing boat harbour.

Additional charting surveys of the course area were carried out. Investigation work and the development of concept plans for other recreational boat harbours continued for Busselton, Sorrento, Geraldton and Carnarvon. A twin boat launching ramp was constructed at Geraldton.

Another important work carried out was the maintaining and calibrating the many tidal recorders from Wyndham to Esperance.

Appendix 06
Navigational Aids
Early History

Since the settlement of the Swan River Colony (Western Australia) in 1829 the State's coastline and adjoining waters have been progressively surveyed as the State developed. Theses initial surveys were incorporated in British Admiralty (BA) Charts and later updated and extended with the new information being reproduced on the Australian hydrographic (Aus) chart. The latter information was produced with survey interaction between the Australian Navy and the Hydrographic section of the Harbours and Rivers Branch of the Public Works Department of WA.

Navigation aids established included light houses or towers to mark specific landfalls such as the Lighthouse on Wadjemup Hill on Rottnest Island with a light visible from 23 miles. Other aids included front and rear leading beacons to guide vessels into the safe navigation channel, port and starboard markers to define navigable channel, beacons to mark shoals or reefs and sector lights to show prohibited waters

Prior to 1915 the responsibility for the provision of navigational aids rested with the State. After 1915 all aids outside State gazetted port areas became the responsibility of the Commonwealth Government. In more recent times the control of some of these structures which have become inactive, particularly lighthouses, have been taken over by local authorities or by conservation or heritage groups

It should be noted that the list below is not complete as it does not show the leading beacons and channel markers, which have already been included in the main body of the text.

King Point

One of the earliest light houses was a 30 feet (9 metres) skeletal tower which was built at King Point Albany in 1858 on the north side of the narrow entrance to Princess Royal Harbour. The light has been inactive for many years.

Port Denison

A stone obelisk at Leander Point, Port Denison which was erected in 1869 is one of the earliest day beacons in the State....

Point Moore

The Point Moore Lighthouse at Geraldton was prefabricated in England. was erected on its original site in 1876 and relocated to its present position in 1878, It has 112 feet (34 metres) focal plane. It is still active.

Bluff Point

The Bluff Point Light at Geraldton was erected in 1876 became inactive in 1952

Jarman Island

In 1888 a 51 feet (15.5 metres) cast iron tower was erected on Jarman Island near Point Samson and 2 miles (3 kilometres) north east of the port of Cossack on the western side of Butcher Inlet, which was established in 1872. The light operated until 1987/.

Cape Leeuwin

In the south of the State, one of the earliest lighthouses was at Cape Leeuwin where a 115 feet high limestone tower was opened in 1896. It had a focal plane of 185 feet (56 metres)

Rottnest Island

In 1896 a 112 feet high limestone tower was erected at Rottnest to replace an earlier structure built in 1840. The new lighthouse had a focal plane 152 feet above high water and was visible for 23 miles.

Babbage Island

A less elaborate timber lighthouse was built on Babbage Island at Carnarvon in 1896 which with a 60 feet high tower and a focal plane at 102 feet was visible at a range of 15 miles. It ceased to operate in 1961 and was replaced in 1062.

Rottnest Island

In 1900 a second light house was erected at Bathurst Point, Rottnest. This light had a focal plane of 98 feet (30 metres) and ser served as a rear light of a range guiding ships departing Fremantle past the Kingston reefs.

Breaksea Island

In 18.58 a (survey) station was established on Breaksea Island at Albany but it was not until 1901 that a 51 feet (15.5 metres) high round cylindrical tower was erected with a focal plane of 590 feet (119 metres). There were at one stage three light keepers' houses on the island.

Woodman Point

A 42 feet (13 metres (cylindrical stone tower was built inland on high land at Woodman Point, Fremantle area proving a light at a focal plan of 123 feet (37 metres).

Fremantle

In 1903 a 30 feet (9 meters) high light house with a 49 feet (15 metres) focal plane was erected at the end of the South Mole at the entrance to Fremantle Harbour.

Cape Naturaliste

In 1904 a 65 feet (20 metres) limestone lighthouse was built at Cape Naturaliste west of Busselton. The light has a focal plane of 404 feet (123 metres).

Fremantle
In 1906 a 30 feet (9 meters) high light house with a 49 feet (15 metres) focal plane was erected at the end of the North Mole at the entrance to Fremantle Harbour.

Point Cloates

In 1910 a 47 feet high sandstone tower was built at Point Cloates 200 miles north of Cape Inscription with a 15 mile range of light. The light ceased operation after 1832

Cape Inscription

In 1910 a 34 feet high concrete light house was built at Cape Inscription at the most northern tip of Dirk Hartog Island, the only access to it being over a 232 feet long jetty

Vlaming Head

In 1912 as33feet (10 metres) high light house was erected at Vlaming Head at North West Cape in 1912 with keepers houses. The light operated until 1967/

Cape Leveque

In 1912 a lighthouse with a focal plane of 142 feet (43 metres) was built at Cape Leveque on the southern entrance to Kind Sound. The light is still in operation...

Eclipse Island

In `1926 a 36 feet (14 metres) concrete light house was built on Eclipse Island at Albany. The light was at a 181 feet (117 metres) focal plane and was active until 1976.

Point Quobba

In 1950 a 61 feet (18.5 metres) cylindrical tower was erected at Point Quobba on a 310 feet (64 metres) focal plane. The light is 50 miles (80 kilometers) north of Carnarvon.

Casuarina Point

The site for the lighthouse at Casuarina Point, Bunbury was established in 1870 and the first lighthouse was built in 1959 with a focal plane of 142 feet (43 meters) In 1951 the height of the tower was increased to 82 feet (25 metres) The steel black and white checkerboard patterned lighthouse was prefabricated in Perth and erected at Bunbury.

Tanner Island

In 1951 a 20 feet (6 metres) square concrete tower to take a light on a 77 feet (24 metres) focal plane was erected on Tanner Island 1 the Buccaneer Archipelago. Te light is still operative.

Adele Island

The light on Adele Island was located on the top of a 98 feet (30 metres) skeletal; steel tower erected in 1951. Adele Island is a remote island at the southern end of a reef system about 155 milers (250 kilometers) north of Derby.

Shoal Point

In 1958 a 20 feet (6 metres) brick tower was built at Shoal Point about 19 miles (39 kilometres) south of Kalbarri to mount a light at a 380 feet (118 metres) focal plane.

Babbage Island

In 1962 a 60 feet (18 metres) square skeletal tower was erected on Babbage Island at Cararvon to replace the 1896 tower. The new tower had a light at the focal plane of 98 feet (30 metres).

Foul Bay

In 1967 a 20feet (6 metres0 high concrete tower was erected in 1967 to replaces an earlier lighthouse on nearby Hamelin Bay.

Caffarelli Island 1

Caffarelli Island is one of highest of the many islands in the Buccaneer Archipelago In 1967 a light with a focal plane of 428 feet (130 metres) was established on a 21 feet (6 metres) high steel tower.

Buckland Hill

In 1970 a 33 feet (10 metres) high tower with a focal plane of 216 feet (66 metes) was erected at Buckland Hill just north of Fremantle. Its function us to guide ships into Fremantle on their final approach to the port.

Impericuse Reef

In 1970 a 98 feet (30 metres) high stainless steel tubular tower was erected on the southern most of the coral reefs, known as Rowley Shoals about 160 miles (260 kilometres) west of Broome.

Pelsart Island

In 1974 a 66 feet (30 metres) high stainless steel towel with a focal plane of 70 feet (21 metres) was erected on Pelsart Island near the southern end of the Abrrolhos Islands about 40 miles (60 kilometres) west of Geraldton

Cave Point

A light was installed at Cave Point on the south shore at Albany in 1976. It became inactive in 1994

North Sandy Island

In 1980 a 53 feet (16 metres) high Tapered steel skeletal tower was erected on an island about 30 miles (50 kilometres) north east of Onslow. The light is still active.

Airlie Island

Airlie Island is about 17 miles (27 kilometres) north of Onslow, where a 69 feet * 21 metres _ steel skeletal tower was erected in 1980

Bedout Island

A light with an 89 feet (34 metres) focal plane was erected on Bedout Island 60 miles north east of Port Hedland in 1980,

Gantheaume Point Broome

A station was established at Gantheaume Point, Broome pm 1905.
In 1984a 75 feet (23 metres) skeletal tower replaced an earlier light giving a 108 feet (33 metres) focal plane.

Guilderton

In 1983 a 90 feet (30 metres) tapered brick tower was built at Guilderton at the mouth of the Moore River. The light has a focal plane of 243 feet (74 metres)

Hillarys BH

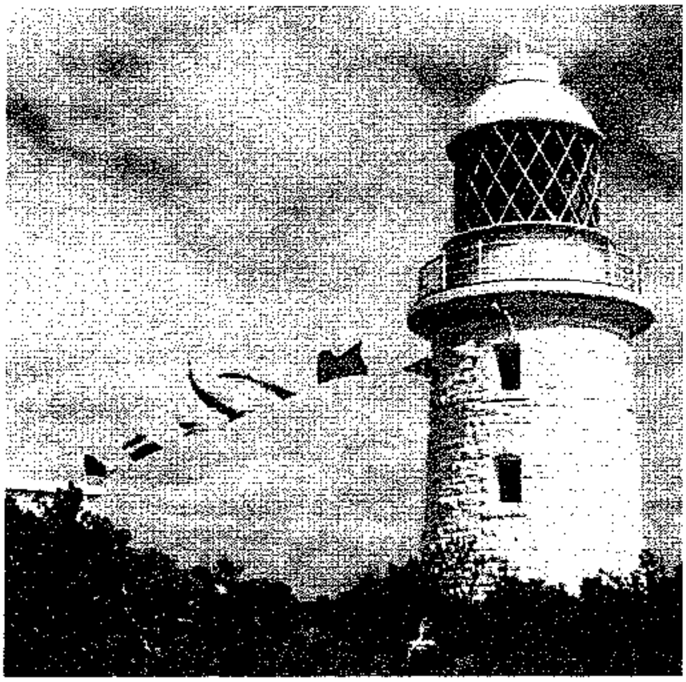
IN 1986 a 65 feet (29 metres) high steel skeletal tower was erected at the end of the north breakwater at Hilarys Boat Harbour.

Degerando Island

Degeraqndo Island, located near the northern entrance to Collier Bay in the West Kimberley has a 30 feet (6 metres) tower installed on a high point on the island giving a focal plane at 132 feet (27 metres)

Lacrosse Island

A 20 feet (6 metres) high tower on Lacrosse Island, a small island in the mouth of Cambridge Gulf has a 379 feet (113 metres) focal plane.



References – Building a State..JSH Le Page.
Port Related Structures........ DA Cumming
Lighthouses Western Australia.... Pauline O'Briem

Appendix 07
Dredging and Reclamation

Dredging and reclamation works were carried out by the Harbours and Rivers Branch in the ocean, estuarine and river environment from Wyndham to Esperance using many types of dredging (and earth moving equipment) and dredging methods. Many of the projects were carried out using departmentally owned plant operated by day labour or else by contract.

Bucket Dredge *Parmelia*

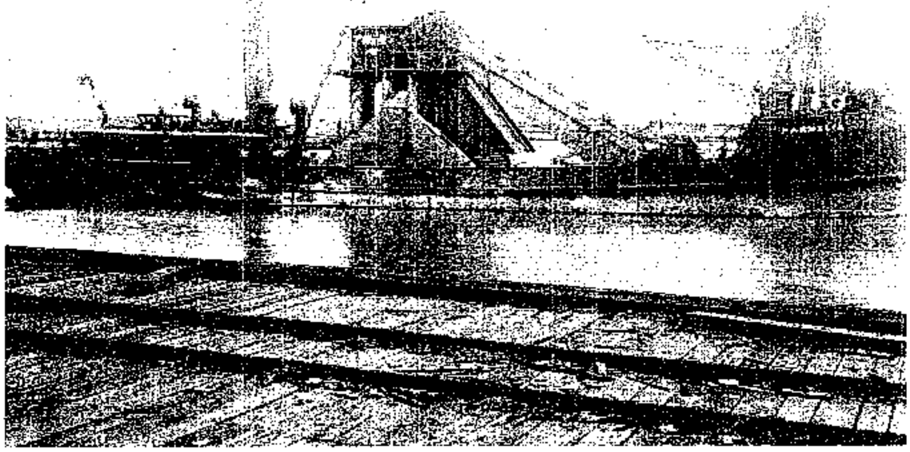
One of the oldest departmental dredges employed was the self propelled ocean going bucket dredge "Parmelia" which was used in the initial dredging of the Fremantle Harbour in 1898 and much later, after a major refit was used in with other dredges for dredging a channel through Success and Parmelia banks to give better access to Cockburn Sound. This work which was carried out for the Commonwealth Defence Department was commenced in 1942 and completed in 1945.

In the 1950s the dredge "Parmelia" was employed at Bunbury in conjunction with the departmentally owned cutter suction dredge "Governor" and the rockbreaker "Lobnitz" for the deepening of the outer harbour...

The basic tool of the bucket dredge is the endless chain of buckets, each fitted with a strengthened hard cutting edge and the whole chain supported on a depth adjustable "ladder" located in a well along the centre of the vessel. Material picked up from the sea bed is carried to an elevated point at the top of the chain and discharged into a hopper, which when full is later dumped into deeper water by the opening of drop doors in the bottom of the hopper.

The restrictions to this type dredging is the degree of the hardness of the material being removed in relation to the cutting edge of the bucket, the dimension of the material in the bucket in relation to the width of the bucket and the width and clearances in the well, the weight of the material in relation to the power of the drive and last but most important the sea conditions at the time, particularly even moderate swell,

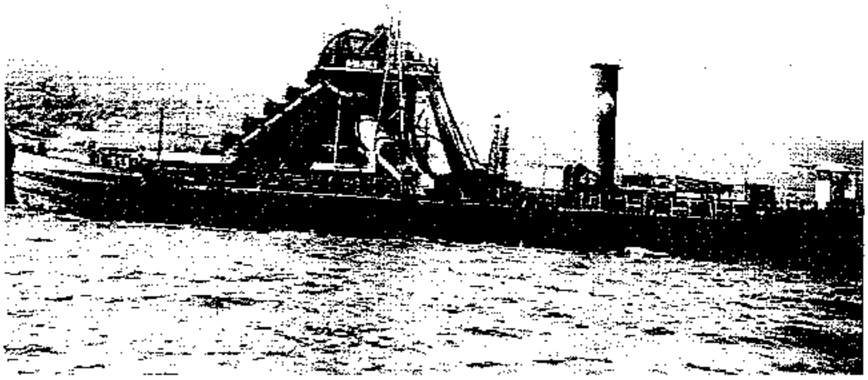
In the case of the dredging at Bunbury, the material to be removed from the harbour bed was dense basalt rock. Prior to dredging, this material was broken up using, for the want of a better word, a 20 ton "needle " point drop hammer which operated similarly to the monkey on a pile driving rig. The "Lobnitz" rock breaker unit comprised a large pontoon, on which was mounted the frame to take the 30 feet length hammer and the steam powered winches to continuously elevate \the needle and then let gravity take over as the point of the needle chipped away at the basalt face. The bucket dredge then took over to remove the fragmented rock and later discharge it at sea in deeper water.



The ocean going bucket dredge "Parmelia" used in the initial dredging of the Fremantle Harbour in 1898 - acknowledgement Old Fremantle John Dowson

Bucket Dredge - GGA Australian Dredging Company

This dredge was involved in the development of Albany Harbour in the 1950s



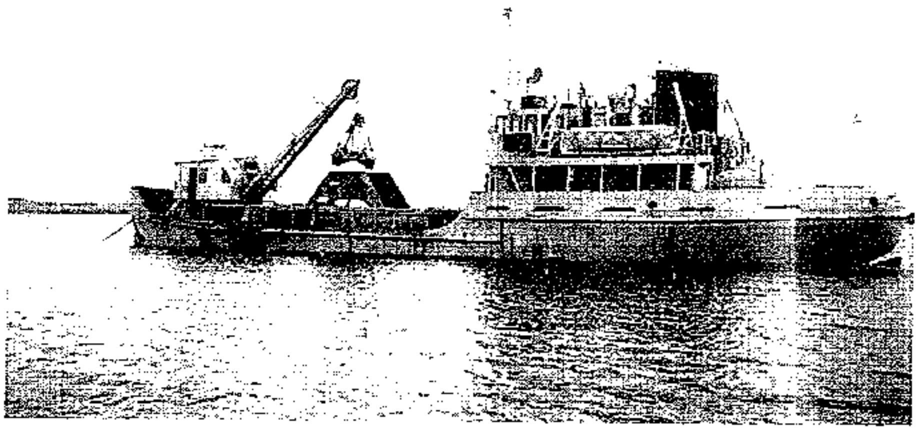
Bucket Dredge GGA Australian Dredging Company Albany 1953

Length	***159' 0"***	***Beam***	***39' 6"***
Depth	***11' 6"***	***Draught***	***8' 0"***
IHP	***450***		

Acknowledgement TG Leaver

Grab Dredge *Fremantle*

For many years the Branch operated the grab dredge Fremantle, which was a self propelled ocean going vessel. At the bow it carried a Priestman grab crane and at midships a bottom dump hopper into which grabbed material was placed and later dumped at sea. This dredge was used initially at Albany and then later uses extensively at Wyndham for maintenance dredging at the jetty berths...



Grab Dredge "Fremantle:" at Albany 1953
Acknowledgement TG Leaver

Cutter Section and Trailing Dredges

The Branch operated at various times five departmentally owned suction dredges, cutter, trailing and with discharge to hopper or through pipeline. The suction dredge was as its name implies like a super vacuum cleaner or centrifugal pump mounted on a barge, In all cases the dredged material was either pumped at low head into an on board receival hopper or to a separate barge or else pumped at a high head through a pipe line to a reclaimed area or to a dump area, In some cases the dredged material was "side casted" (jetted) at some distance to spoil banks away from the area being dredged

In soft or free flowing material the end of the suction was plain and picked up the material by using a depth controlled trailing suction line, alongside the vessel and which operated as the dredge was travelling with material being discharged into separate bottom dump barges or to a inboard bottom dump hopper. In other cases the plain end suction inlet pipe was located in a well at the bow of the vessel and moved forward into the material being dredged by the use of quarter moorings at the bow end of the vessel or by spuds at the stern end...

Where the material being dredged was harder or not free flowing a circular cutter was attached ahead of the end of the forward suction pipe

which cut up the material and allowed it to "run" to the pipe. In other cases it was necessary to break up the material using external means as explosives or a mechanical rock breaker.

Suction Dredge *Stirling*

The departmentally owned 20"cutter suction dredge "Stirling", which was not self propelled operated only in estuarine and river areas. It depended on attendant craft for moving from site to site and used a conventional bow, quarter and aft mooring set up and spuds whilst dredging with the spoil being pumped to reclamation.

For the dredge to pass under the causeway when proceeding to up river dredging sites it was necessary to "sink" the dredge with water ballast to give sufficient clearance between the top of the dredge superstructure and the underside of the bridge's beams

This dredge carried out extensive dredging and reclamation in the Swan River, which included the then industrial area between the bridges in North Fremantle, Preston Point channel and reclamation at Preston Point, Garvey Park, Point Walter, Maylands mainly to improve the river flow,

Some of the larger projects carried out by the "Stirling "between 1957 and 1960 included the dredging of 3 million cubic yards of material from the Mill Point Spit, Narrows, Barrack and Mends Street channels to reclamation along Mounts Bay Road and the dredging of 2.2 million cubic yards of sand between Mill Point and Canning Bridge to reclamation for the Kwinana Freeway.

Full details of all Swan and Caning River dredging carried out between 1892 and 1976 are shown at page 99. It should also be noted that earlier dredging was carried out by dredges other than the "Stirling" and that although the bulk of the work since 1957 was carried out by the "Stirling" some minor works were carried by the 8" CS dredge PW 8. – see page 102w
The "Stirling" also carried out the dredging of the ocean cut between Leschenault Estuary and Koombana Bay at Bunbury between January 1950 and May 1951.

Suction Dredge *PW 8*

The departmentally owned transportable cutter suction dredge "PW 8", which, like the "Stirling", but much smaller, was not self propelled and operated in estuarine and river areas through the State.

The dredge together with all its ancillary items was transported from site to site by road. It depended on attendant craft for moving to the dredging site in the waterway and used a forward quarter mooring setup for moving cross the dredge face, together with two spuds at the stern quarter points for moving forward. The two spuds were alternatively

raised and lowered as the dredge was winched from one side of the cut to the other side.

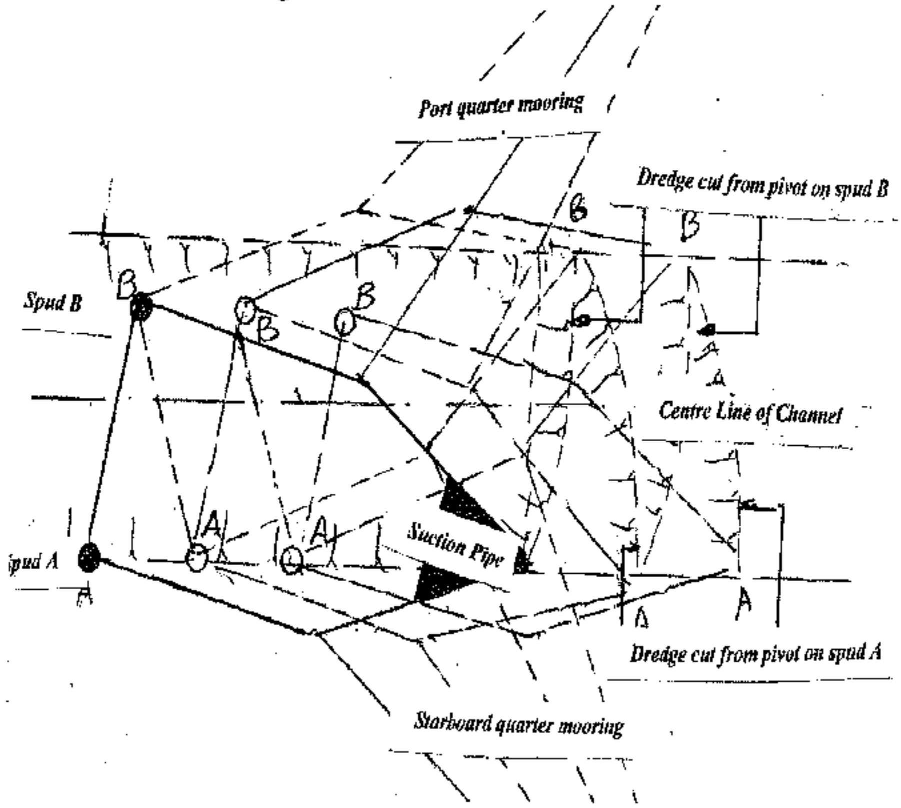
Since dredge "PW 8 "commended operations it carried our dredging at Emu Point Albany basin and approach to Emu Point small boat harbour.

Denmark and Frankland River and Walpole navigation channels

Bunbury Collie River dredging.

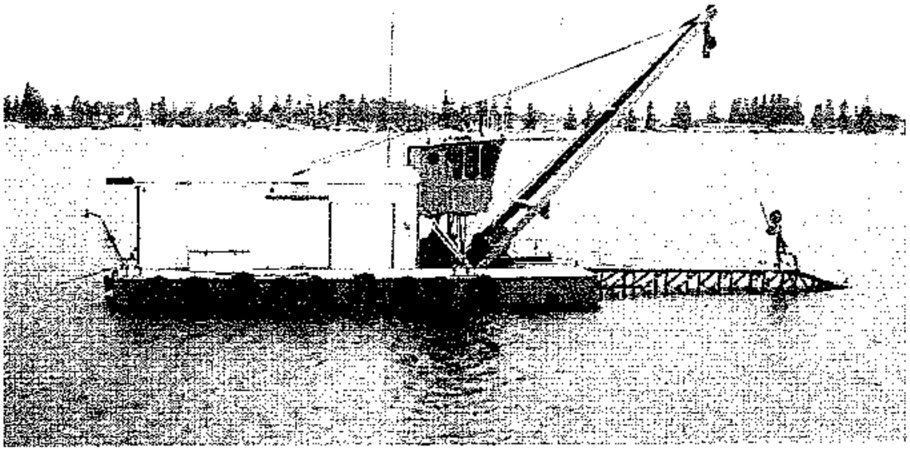
Leschenault Estuary   Paris Road Launching Ramps

Other dredging was carried at Deep River, Murray Serpentine Rivers, John Creek at Point Samson, Beadon Creek at Onslow, Mandurah and in the Swan and Canning Rivers.



Dredging phases of a dredge operating on stern spuds

Esperance Port Authority Suction Dredge



The cutter suction dredge "Esperance", designed by Consulting Engineer Keith Dodd and built by Crewe and Sons of Perth on behalf of the Branch for the Esperance Port Authority. It was taken over by the authority in 1979 and used on maintenance dredging within the port area.

Swan River Dredging by Harbours and Rivers Branch 1892 – 1954

LOCATION OF DREDGING AND SPOIL FROM 1892-1976 CARRIED OUT BY PUBLIC WORKS DEPARTMENT

DATE	LOCATION OF DREDGING	REASON	AMOUNT cu. m.	LOCATION OF SPOIL
1892-1896	Fremantle Harbour and entrance			
1895-1896	Claisebrook channel from Guildford	Navigation	1 414 008	Northern bank and Arthur Head
1896-1897	Canning River to Kennedy's landing	Navigation	5 293 071	Foreshore
1897-1901	Barrack St. Jetty and Mends St. channel	Navigation	10 167	Foreshore
1901-1905	Barrack St. Jetty and Mends St., Coode St. channel	Navigation	31 681	Deep water
1914-1922	Fremantle Harbour and entrance	Navigation	30 000	Barrack Square
1909-1910	Barrack St. to Narrows channel	Navigation	986 895	Ocean
1908-1912	Lord St. to Causeway	Navigation	60 000	Mounts Bay reclamation
1920-1930	Fremantle Harbour	Navigation	20 000	Riverside Drive and Mounts Bay Rd.
1922-1926	East Perth Power House	Navigation	602 421	Ocean
1822-1929	Channels in Perth Water	Construc.	29 705	Shell for roads
1927-1928	East Perth-Langley Park	Construc.	103 260	Riverside Drive roads
1927-1926	Causeway	Mosquito control	132 345	Foreshore Langley Park
1929-1935	Barrack St. to Causeway and Heirisson Island	Navigation	20 488	Heirisson Island
1935-1936	Melville	Navigation	787 299	Causeway and Heirissor Island
1935-1939	South Perth from Mill Point	Mosquito control	136 170	Melville foreshore
1936	Pelican Point	Mosquito control	163 842	Foreshore South Perth
1936	Armstrong Spit and Dalkeith	Mosquito control	95 372	Royal Perth Yacht Club
1936-1939	Causeway to Manning Point	Mosquito control	342 743	Foreshore Dalkeith
1936-1938	Nedlands, Dalkeith, Subiaco scheme	Navigation	400 129	Foreshore and Heirisson Island
1937-1938	Causeway	Mosquito control	2 076 760	Nedlands foreshore
1939-1941	Mill Point Rd. to Coode St. and Millers Pool	Navigation	20 488	Heirisson Island
1936-1940	Fremantle Harbour	Mosquito control	404 127	Foreshore South Perth
1946-1964	Causeway up to Bunbury Bridge	Navigation	264 600	Ocean
1946-1949	Inner harbour Fremantle	Flood control	1 060 935	Heirisson Island, Victoria Park
1947-1950	Fremantle Harbour entrance	Navigation	10 058	Ocean
1950	Garratt Rd. Bridge	Navigation	90 909	Ocean
1950	Maylands Swimming Club	Construc.	small	Shell for cement
1952-1954	Upstream and downstream from Causeway	Recreation	small	Maylands foreshore
		Construc.	920 820	Heirisson Island Hay St. Bank

Swan River Dredging by Harbours and Rivers Branch 1956 - 1965

LOCATION OF DREDGING AND SPOIL FROM 1892-1976 CARRIED OUT BY PUBLIC WORKS DEPARTMENT CONTINUED

DATE	LOCATION OF DREDGING	REASON	AMOUNT cu. m.	LOCATION OF SPOIL
1954	Pelican Point	Foreshore protection	small	Mounts Bay Sailing Club
1956-1962	East end Fremantle Harbour	Construc.	2 217 266	North Wharf, No. 10
1956-1962	Fremantle channel and 'Knuckle'	Navigation	123 804	Reclamation North Wharf
1958-1962	Fremantle Harbour entrance	Navigation	181 570	Reclamation North Wharf
1958-1962	Fremantle Harbour	Navigation	675 319	Reclamation North Wharf
1956	Narrows to Barrack Street and Mill Point Spit	Navigation	425 172	Mounts Bay Rd. and Mill Point
1957-1960	Mill Point, Narrows, Barrack St., and Mends St. channel	Construc.	1 149 598	Mounts Bay reclamation
1957-1960	Barrack St. jetties	Construc.	10 853	Mounts Bay reclamation
1957-1960	Mill Point	Construc.	348 195	Shell for Mounts Bay Rd.
1957-1960	Mill Point — South	Construc.	1 325 427	Mounts Bay reclamation
1958-1960	Como to Canning Bridge	Construc.	637 690	Kwinana Freeway
1958-1960	Mill Point — Narrows mud waves	Construc.	1 511 636	Kwinana Freeway
1958-1960	South Perth Yacht Club	Recreation	577 580	Point Heathcote
1959	Downstream Canning Bridge	Foreshore protection	233 592	Canning Bridge embankment
1959	Nedlands Yacht Club	Recreation	9 211	Foreshore Nedlands
1960-1961	Perth Water at South Perth	Recreation	422 037	Sir James Mitchell Park
1960&1962	Waylen Bay	Recreation	100 000	Foreshore Applecross
1962	Barrack St. jetties	Navigation	small	Deep water
1962&1964	Nedlands and Pelican Point	Recreation	7 268	Perth Flying Squadron
1962-1963	Preston Point	Recreation	22 958	Preston Point foreshore
1962-1964	Point Walter	Recreation	20 943	Point Walter foreshore
1962	Empire Games Rowing Course	Recreation	30 600	Rowing Association Club House
1962	Fremantle	Recreation	29 680	Fremantle Rowing Club
1963	Upstream Fremantle Traffic Bridge	Foreshore protection	64 260	North Fremantle
1964-1965	Point Walter to Point Waylen	Recreation	263 160	Attadale foreshore
1960-1964	Canning River, Rivervale	Mosquito control	284 580	South-eastern bank
1964	Chidley Point	Recreation	small	Chidley Point foreshore
1965-1967	Upstream from Causeway	Flood control	735 473	Rivervale foreshore
1965-1966	Barrack St. jetties, drains and channels	Navigation	45 464	Deep water
1965	Narrows	Construc.	158 355	Mitchell Freeway
1965	Site of old North Fremantle Traffic Bridge	Navigation	2 502	Ocean
1965	North Fremantle	Construc.	75 520	North Fremantle

Swan River Dredging by Harbours and Rivers Branch 1967 - 1976

LOCATION OF DREDGING AND SPOIL FROM 1892-1976 CARRIED OUT BY PUBLIC WORKS DEPARTMENT CONTINUED

DATE	LOCATION OF DREDGING	REASON	AMOUNT cu. m.	LOCATION OF SPOIL
1967	Mosman Bay	Beach	5 355	Mosman Bay beach
1968	Bunbury Bridge to East St., Maylands	Flood control	395 505	Burswood Island (Belmont)
1968	Upstream Garratt Rd. Bridge	Flood control	92 565	North bank, Bayswater
1968	Upstream Canning Bridge	Navigation	5 011	Foreshore
1969	Garvey Park	Flood control	227 206	Central Ave., Redcliffe
1969	Point Heathcote	Foreshore protection	16 402	Como Sea Scouts and deep water
1969	Garratt Rd. Bridge	Foreshore protection	10 178	Garratt Rd. Bridge and deep water
1969	Point Walter and Armstrong Spit	Recreation	69 893	Perth Flying Squadron and deep water
1969	South Perth-Melville Water	Foreshore protection	18 781	Kwinana Freeway foreshore
1969	Maylands	Flood control	14 114	Beach
1969	East St., Perth	Navigation	49 779	Burswood Island
1970	South Guildford	Flood control	42 190	Guildford Primary School fields
1967-71	Upstream from Causeway	Flood control	575 460	Maylands Peninsula Stage I
1973-74	Upstream from Causeway	Flood control	900 000	Maylands Peninsula Stage II
1972-73	Upstream from Causeway	Flood control	42 685	Garvey Park
1972	W.A.I.T. Rowing Club — Canning River	Recreation	15 094	Beach
1971	Barrack St. and Spring St. drain	Navigation	42 809	Deep water
1971	North Fremantle	Recreation	61 437	Preston Point foreshore
1971	Swan River Yacht Club and Leeuwin Jetty	Navigation	7 604	Deep water
1971	Point Walter and navigation channel Attadale	Navigation	38 020	Deep water
1972	Como	Foreshore protection	800 000	Como foreshore
1972	Point Walter ramp	Recreation	790 000	Beach
1976	New Mends St. Jetty and channel	Navigation	15 743	Deep water
1976	Maylands Swimming Pool	Recreation	4 700	Beach
1976	Barrack St. Jetty	Navigation	2 243	Deep water
1976	Applecross	Recreation	4 333	Deep water
1976	Canning River Rowing Course	Recreation	small	Foreshore
up to 1952				
1973-76	Upstream and downstream from Causeway	Cement	1 530 000	Shell for Swan Portland Cement
	Upstream and downstream from Causeway	Pipes	8 844	Blizzard Sand Company

Dredging by Harbours and Rivers Branch
1964 - 1968

Job	Period	Quantity Dredged (yd^3)	Total Working Hours	Total Dredging hours
Emu Point Boat Harbour	9/11/64 to 28/6/65	70153	1441	1059
King River	29/6/65 to 19/8/65	18400	396	302
Ski Club	20/8/65 to 10/9/65	3300	126	70
Princess Royal Yacht Club	11/9/65 to 13/11/65	17000	495	351
Harbour Master's Jetty	17/11/65 to 1/12/65	3300	117	80
Frankland River	31/12/65 to 27/4/66	23605	954	685
Deep River	28/4/65 to 1/5/66	11366	261	166
Denmark	27/7/66 to 2/11/66	14332	757	501
Emu Point Boat Harbour	30/11/66 to 16/2/67	26864	675	541
Excavation for West Groyne, Mandurah	1/4/67 to 12/10/67	70700	1378	1029
Serpentine River	17/10/67 to 23/12/67	24800	589	404
Murray River	27/12/67 to 13/2/68	16000	458	347
Sticks Channel	15/2/67 to 13/2/68	8600	302	181

Dredging by Harbours and Rivers Branch
1968 - 1971

Job	Period	Quantity Dredged (yd^3)	Total Working Hours	Total Dredging Hours
Onslow, Beadon Creek	8/6/68 to 18/11/68	68000	2084	1344
Bunbury-Collie River & Australind Boat Harbour	11/1/69 to	76823	2009	1266
Bunbury - Turkey Pt.	to 1/12/69	7962	144	117
Mandurah Bar	2/1/70 to 31/3/70 and 28/5/70 to 3/7/70	40595	872	493
Mandurah, Work for Shire	1/4/70 to 27/5/70	19804	432	272.5
Mandurah, Sticks Channel	20/11/70 to 4/2/71	17559	531	303.25
Mandurah, Swimming Pool	5/2/71 to 15/2/71	1003	63	34.75
Albany - Emu Point Swimming Pool	21/5/71 to 2/7/71	11752	287	180.75
			305	192.2
Emu Point Boat Harbour	7/7/71 to 9/7/71		18	11.5
Frankland River No.1 Cut	18/8/71 to 24/8/71	1045	44	25.75
Frankland River No.2 Cut	25/8/71 to 27/9/71	44764	229	85.75
		6917.4	435	135.5
Frankland River No.3 Cut	28/9/71 to 20/10/71	1396	162	24

Dredging by Harbours and Rivers Branch
1971 - 1975

Job	Period	Quantity Dredged (yd3)	Total Working Hours	Total Dredging Hours
Deep River	22/10/71 to 13/1/72	16029	554.5	300
WAIT Rowing Club (Canning River)	22/2/72 to 19/5/72	19160	593.75	386.5
Matilda Bay Jetties	20/5/72 to 12/6/72	3310	153	68.25
Qantas Ramp	13/6/72 to 6/7/72	2635	171	102.25
Point Walter Ramp	7/7/72 to 27/7/72	5100	153	92.75
Augusta	26/9/72 to 15/9/73	64679	2369	1696.75
Walpole	7/12/73 to 16/5/74	39110	972	591.5
Bunbury Rowing Course	17/8/74 to 18/11/74 & 5/2/75 to 27/2/75	13019	Total Hours 788	526.5
Bunbury Koombana Cut	19/11/74 to 4/2/75	11642	481	240.75
Bunbury Launching Ramp	28/2/75 to 8/3/75	2045	54	33.75
Collie River Mouth	10/3/75 to [illegible]	7466	747	407.25

Dredging by Harbours and Rivers Branch

1976 - 1980

PW 8 Dredge "Leschenault" Job	Period	Quantity Dredged M3	Total Working Hrs:Min	Total Dredging Hrs:Min
	Refit at F.H.W. after return from country work			
Mends St Basin	15.1.76 to 19.3.76	5438	360:00	232:45
Goode St Channel	22.3.76 to 2.7.76	7412	573:00	427:15
Maylands Swimming Pool	7.7.76 to 5.8.76	3574	193:00	108:45
Mends St Jetty	9.8.76 to 23.8.76	400	88:00	27:45
	Repairs at F.H.W.			
Fremantle F.B.H.	27.9.76 to 21.10.76	1555	172:00	99:45
Barrack St Jetties	25.10.76 to 22.11.76	2245	188:30	101:15
Mill St Drain	23.11.76 to 16.12.76	3517	168:00	113:15
Pt Dundas	17.12.76 to 27.1.77	4339	168:00	87:00
	Repairs at F.H.W.			
Canning River W.A.I.T. Rowing Course	17.2.77 to 31.3.77	6136	326:00	200:30
Fremantle South Slip	19.4.77 to 4.5.77	Not known	94:00	58:30
	Idle at F.H.W.			
Fremantle F.B.H.	25.5.77 to 21.10.77	9155	849:00	274:15
	Laid up at F.H.W.			
Fremantle F.B.H.	15.12.79 to 5.3.79	639	72:00	37:45

PW 8 Dredge "Leschènault" Job	Period	Quantity Dredged M3	Total Working Hrs:Min	Total Dredging Hrs:Min
Pickering Park	6.3.79 to 1.8.79	11125	824:00	406:45
	Laid up at F.H.W.			
Preston Pt Channel	12.5.80 to 16.8.80	11268	651:15	336:30
Mandurah Entrance	8.10.80 to 13.2.80	18442	980:30	610:15

Beach Protection

Over the years many types of treatment to combat beach erosion have been carried out in this State, particularly in the Mandurah and Busselton areas where complete streets have been devoured by the ocean. The"soft" treatment has been to replenish the beach with imported sand by either by carting or pumping from outside and retaining it using "temporary" groynes. The other method aptly referred to as the "hard" treatment involved the construction of unyielding sea walls, using large rocks placed along the eroded beach.
However what often happened with this type of treatment was that the erosion problem was transferred further along the beach and the rock wall became buried due to wave action.

Max Anderson use to explain it this way to his grandchildren who lived at Busselton and who spent a lot of time on the Busselton beaches.

It is the start of winter and a wave is breaking on the beach.

The wave is running at an angle just under 90 degrees to the shore line as it moves gently up the sloping beach. At the end of its run and as it recedes it picks up a few grains of sand carrying them in suspension and returning them again to the beach but a little further along. This process is repeated with each wave with the result that the beach in this area begins to erode with some sand being carried offshore and some of it being transported along the beach.

As the season advances and the wave become more active the energy of the breaking wave is absorbed by the beach. On a gentle sloping sandy beach the wave energy is dissipated over the beach, But what happens when the wave speeds up the beach and is met by an unforgiving rock wall? All the energy bottled up in the wave is released on that wall as the wave is reflected and refracted up and down (turbulence), resulting in the sand being pulled out from under the rock wall , the rock wall being undermined and the rocks buried.

Two things now happen – firstly sand is lost from the beach in front of the wall and the beach profile changes and secondly the "pile of rocks" now start to act as a groyne with the beach accreting at the updrift end of the rock wall and the beach eroding back behind the wall at the downdrift end.

The solution is to either keep extending the rock wall until equilibrium is reached somewhere "down the track", possibly saving the foreshore but destroying the beach or else to "cut the losses", let the rock wall " hit bottom" and replenish the beach to its original profile by importing sand

. (The above is very much simplified and applies beaches with large depths of sand. Also the "story" could be expanded to look at the summer pattern when the littoral drift reverses and sand is returned to the beach.)

Quarrying and Breakwater Construction

After being closed for some time during the years of WW 11 the department's quarry at Roelands on the Darling escarpment was reopened in 1947. with the intention of bringing down enough rock for the main breakwater extension and a number of ancillary groynes to be built in and around the harbour.

The method used was termed a coyote blast, whereby a drive was blasted into the face of the quarry for some distance and at bench level. A large chamber was then blasted out at the end of the drive and loaded with a designed amount of explosives... The drive was then sealed and the explosives detonated electrically from some distance away. The resulting blast had the effect of lifting and splitting the diorite and granite at the quarry face, rather than completely shattering it. In quarrying operations, there is always a large amount of small rock and rubble produced in the blasting process. The coyote method tends to reduce the proportion of rubble to the total quantity of rock blasted. For the extension of the breakwater at Bunbury, which was nearly a mile out to sea, there was a requirement for large rock armouring on the sides and end of the breakwater. This method of blasting gave the required size of stone. Even then, some of the larger stone had to be drilled and shot to bring it down to the size, which could be loaded by the cranes in the quarry and the rail wagons transporting the rock from the quarry to Bunbury.

The large capacity steam operated cranes working in the quarry were mounted on rails, which were extended as and when required up to the quarry face. The cranes all carried a heavy timber protection mat, which was suspended from the jib of the crane when any large rocks had to be popped. The empty railway wagons were assembled in marshalling yards a short distance from the quarry and pushed on a prepared track up to the quarry face and loaded one at a time. They were then "ridden" down with the brake on, back to the marshalling yards and assembled ready for the descent down the escarpment to the Roelands railway station on the coastal plain below. The descent was quite steep and the stone wagons were partly braked on the way down. On one particular steep part of the descent there was an emergency run off should the brakes fail. The rakes of wagons were then assembled at the Roelands siding and taken over by the Western Australian Government Railways for transport to the Works sidings at Bunbury. Any empty wagons at Roelands were then returned to the quarry.

At the Bunbury end, the full wagons were taken over by the harbour works railway organisation, for transport to the breakwater and for the unloading. Two types of wagons were used, one for side tipping and one for end tipping. There were three sidings at the end of the breakwater, one on each outside face of the breakwater as close to the edge as safety would permit for the side tipping of rock and one down the middle to the head of the breakwater for the end tipping of rock. The sidings were laid over the rubble core of the breakwater and ballasted with quarry rubble. As the tip head advanced the sidings were extended.

Appendix 09
Pile Driving

Piling

Over the years many types of piles had been used in port structures ranging from untreated timber piles through to steel section or tubular piles.

Timber Piles

To lessen the damage to timber piles by worm borers as teredo and limnoria, piles were treated before being driven by being impregnated with a chemical such as that with an arsenic base or else charred over a low fire and tarred. In other cases, some times after driving, the pile surface in the wind tidal zone, where worm attack was more severe, was covered with a membrane such as concrete (in situ or sleeved), copper sheeting or a plastic. Depending on the type of material into which the pile was being driven the toe of the pile was fitted with a steel tapered shoe. To prevent the top of the pile from splitting during driving a steel ring was fitted to the top of the pile. Also where there was insufficient length timber available for the required pile length, piles were fitted with a steel sleeve and spliced using a strong adhesive such as araldite. (Thus was the case for the timber piles required for the fender system at Wyndham in the 1960s.)

Concrete Piles

Reinforced concrete piles of square and octagonal section, often cast on or near the construction site gradually took over from timber piles but not without some problems. Due to the marine environment, strict control was required on the selection of aggregates used in the concrete mix, the thickness of concrete cover over the reinforcement steel and the mixing, placing and curing of the concrete. (This was the case of the precast concrete piles and structural members used in part of the reconstructed Onslow jetty).

Steel Piles

In the middle of the 1900s, steel piles took the place of timber and concrete with the majority of marine strictures erected since 1960 being built with tubular steel piles. One of the problems ever evident with steel piles was the continual protection of the steel surface from corrosion in a heavy salt marine environment. One way was to do nothing and use thicker plate in the pile allowing it to be corroded within a safe plate thickness over the required life of the structure. The usual way however it to treat the steel surface prior to driving the pile with a rust inhibitor and a metallic paint together with either a sacrificial or impressed current

cathodic protection installation. To prevent any internal corrosion of the tubular steel pile the pile if driven open ended it was concrete plugged at the lower end on the completion of the driving.

Sheet Piling

Although the foregoing has mainly referred to vertically loaded piles it also covers sheet piling taking horizontal loads. Earlier timber sheet piling was "bird mouthed" along the length of the pile. Concrete sheet piling was cast with a " lip: along the length of the pile, whilst steel sheet piling had a " clutch", running the length of the pile and which guided the sheet following.

Pile Driving

The principal of pile driving has not changed over the years in that it simply involves hitting the top of the pile with a weight sufficient enough to drive the pile to a depth on the ground required to support a designed load.

This is achieved by repeatedly lifting a weight to a predetermined height and dropping it on the pile head (potential energy) or by using a type of pneumatic, steam or electrically driven hammer mounted on top of the pile which imparts kinetic energy to drive the pile.

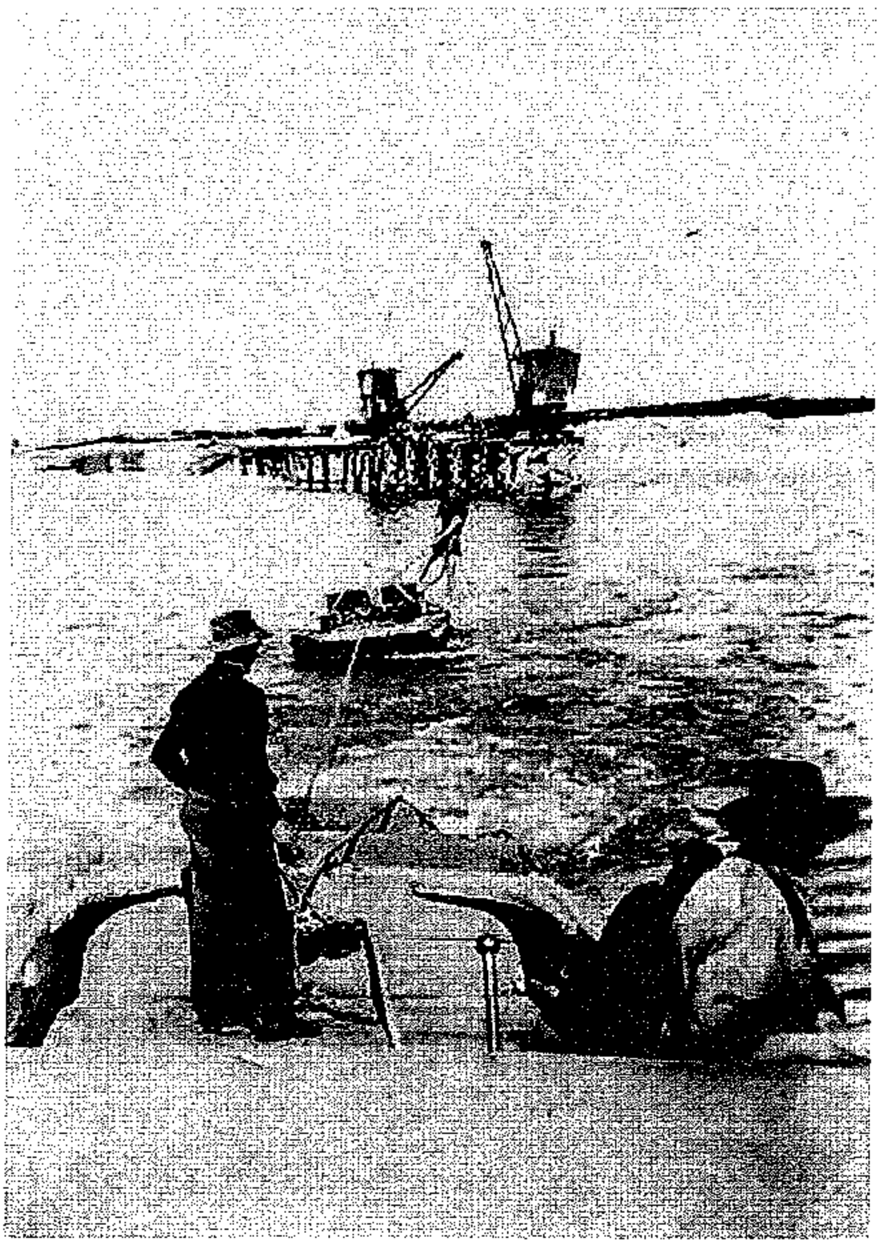
A third method of driving is to jet the pile in using one or two water jets on each side of the pile. This method is used more in sand and less homogeneous materials and is sometimes used in conjunction with the preceding.

Pile Driving Construction Methods

In jetty and wharf construction two construction methods were used for pile driving. One was to cantilever the pile frame out from the Jetty structure and drive piles from topside, The other one was to use a pile frame mounted on a barge and drive piles from the water. Both methods had their problems. With the cantilever system, the top structure would have had to be practically completed and/ or else sufficiently strengthened to take the construction equipment, before proceeding on to the next pier. In using floating plant, very tight control of the barge was required, particularly when operating in the strong tidal currents as in Cambridge Gulf or King Sound,

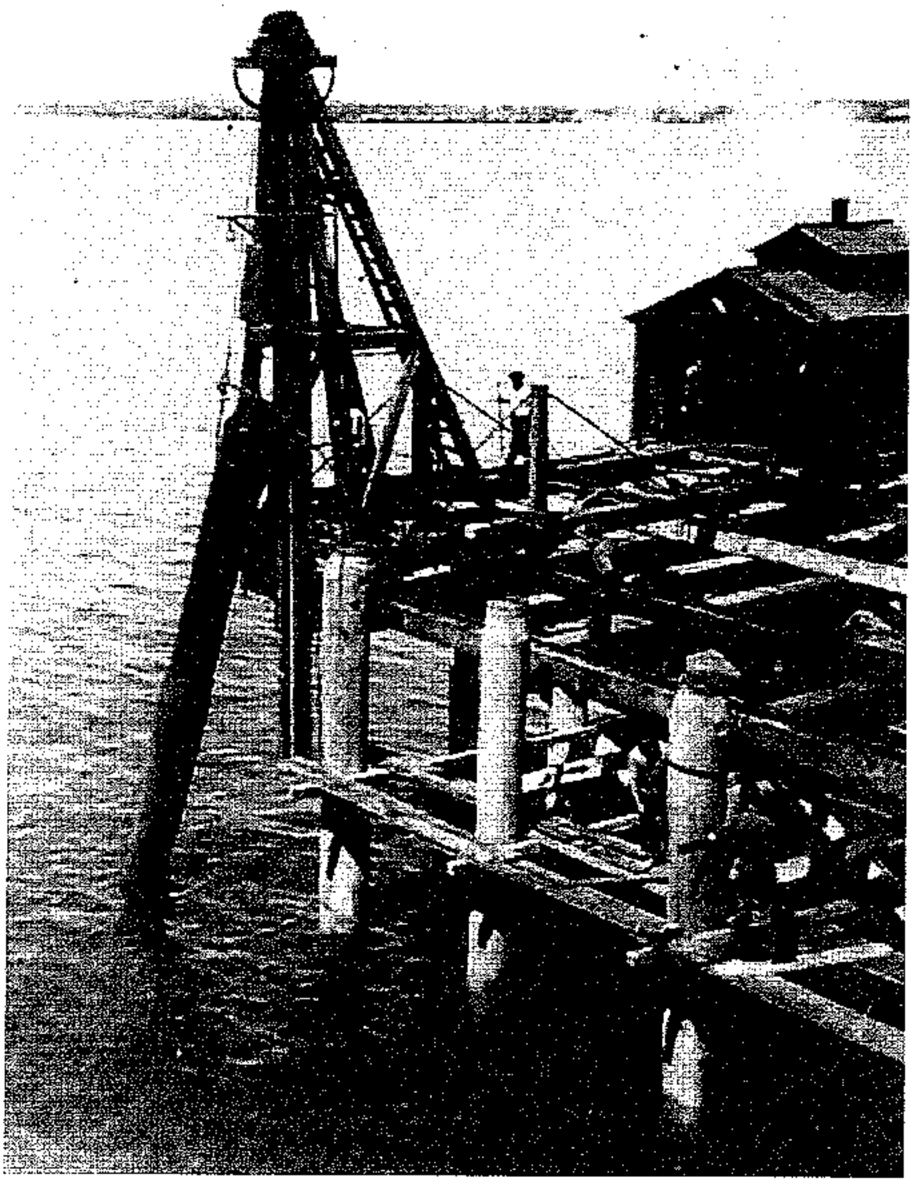
In the following pages the two methods of construction are outlined, the first being the construction of the 600 feet length eleven pile width extension of the Bunbury timber jetty in the mid 1950s using two outriggers and the other being the construction of the steel piled jetty at Derby in the early 1960s using floating plant.

Pile Driving Using Outriggers



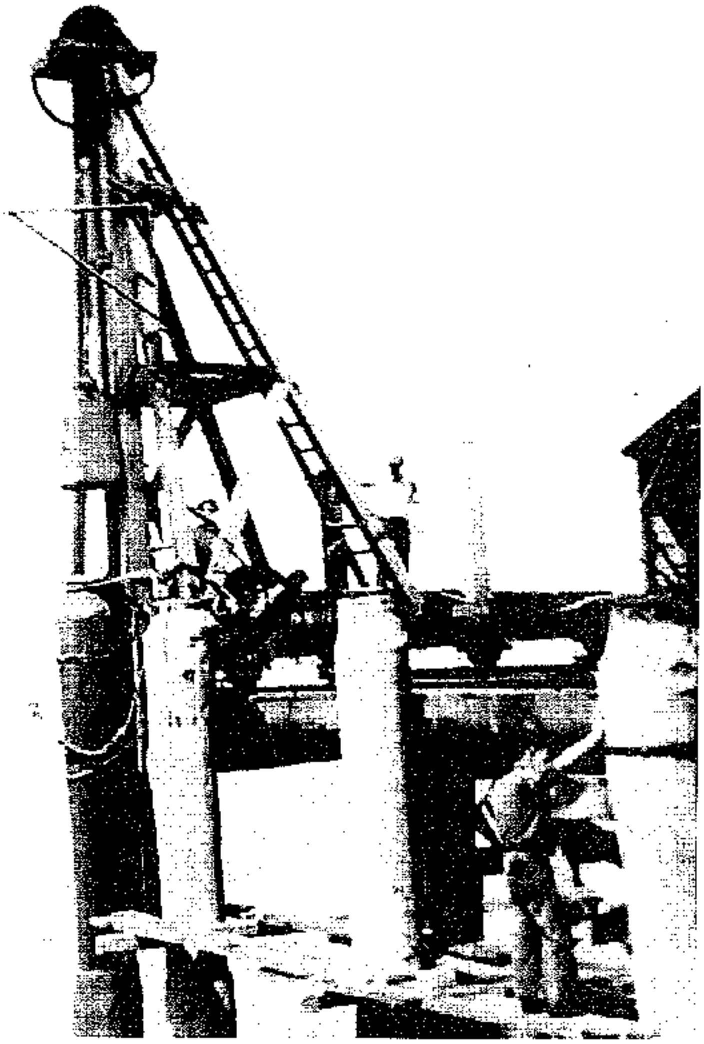
Bunbury 600 feet jetty extension 1952 - 1957

Transporting the gunited timber piles from the pile yard jetty to the construction site. The partly covered concrete sprayed jarrah piles were floated out to the site using a winch mounted pontoon to support the toe of the pile to give some buoyancy. On reaching the site, the head of the pile was lifted up by the pile driving winch and the toe lowered to the seabed from the winch mounted on the pontoon



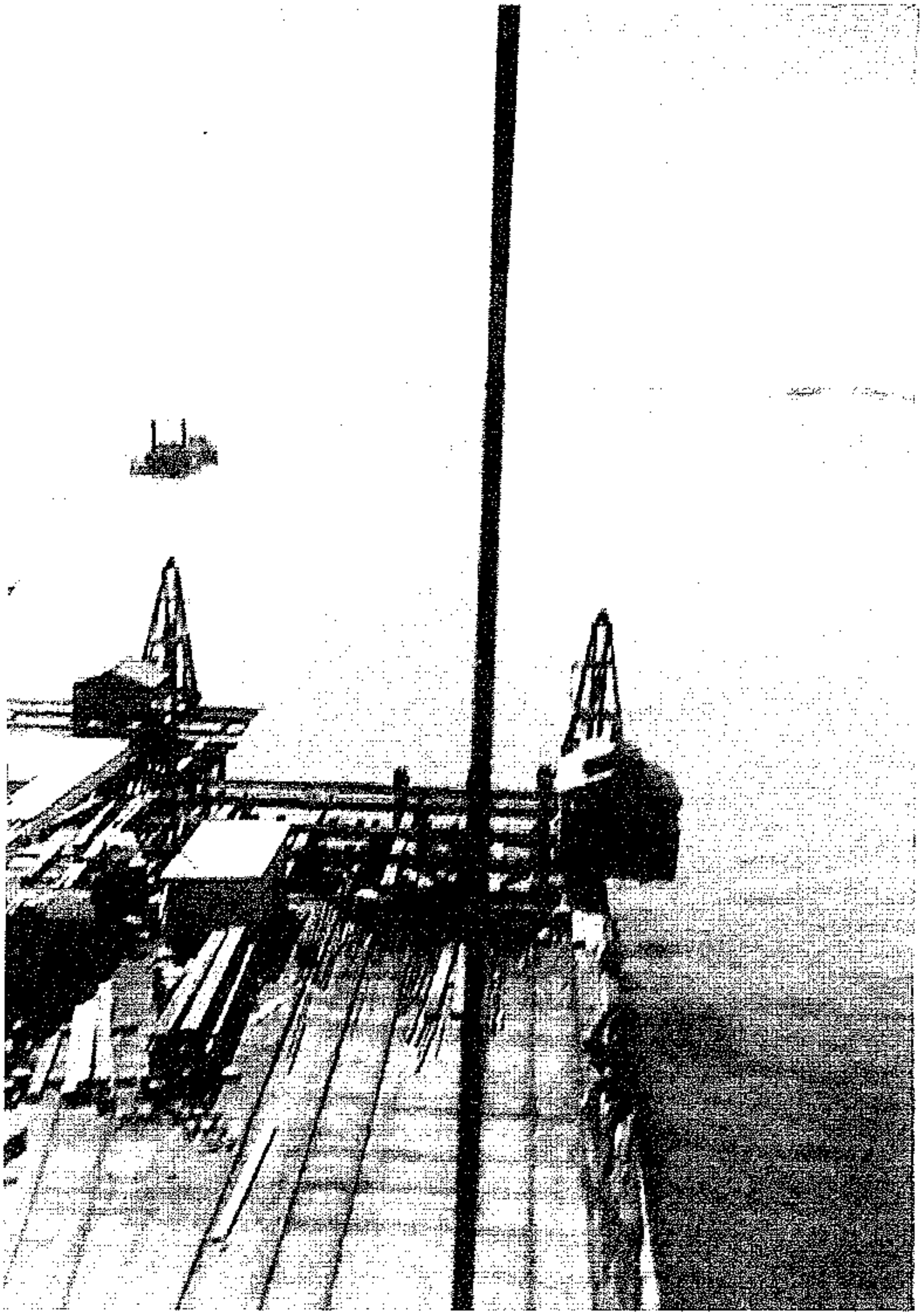
Bunbury 600 feet jetty extension 1952 – 1957

Pitching the pile in preparation for pile driving. The pile frame was mounted on a timber base structure, which carried the steam driven winches and boiler on the shoreward end. The whole unit was mounted on flanged wheels which allowed the assembly to travel on rails across the jetty to the selected pile location. The first unit covered 6 piles while the second unit (not shown above) covered the remaining six pile positions.

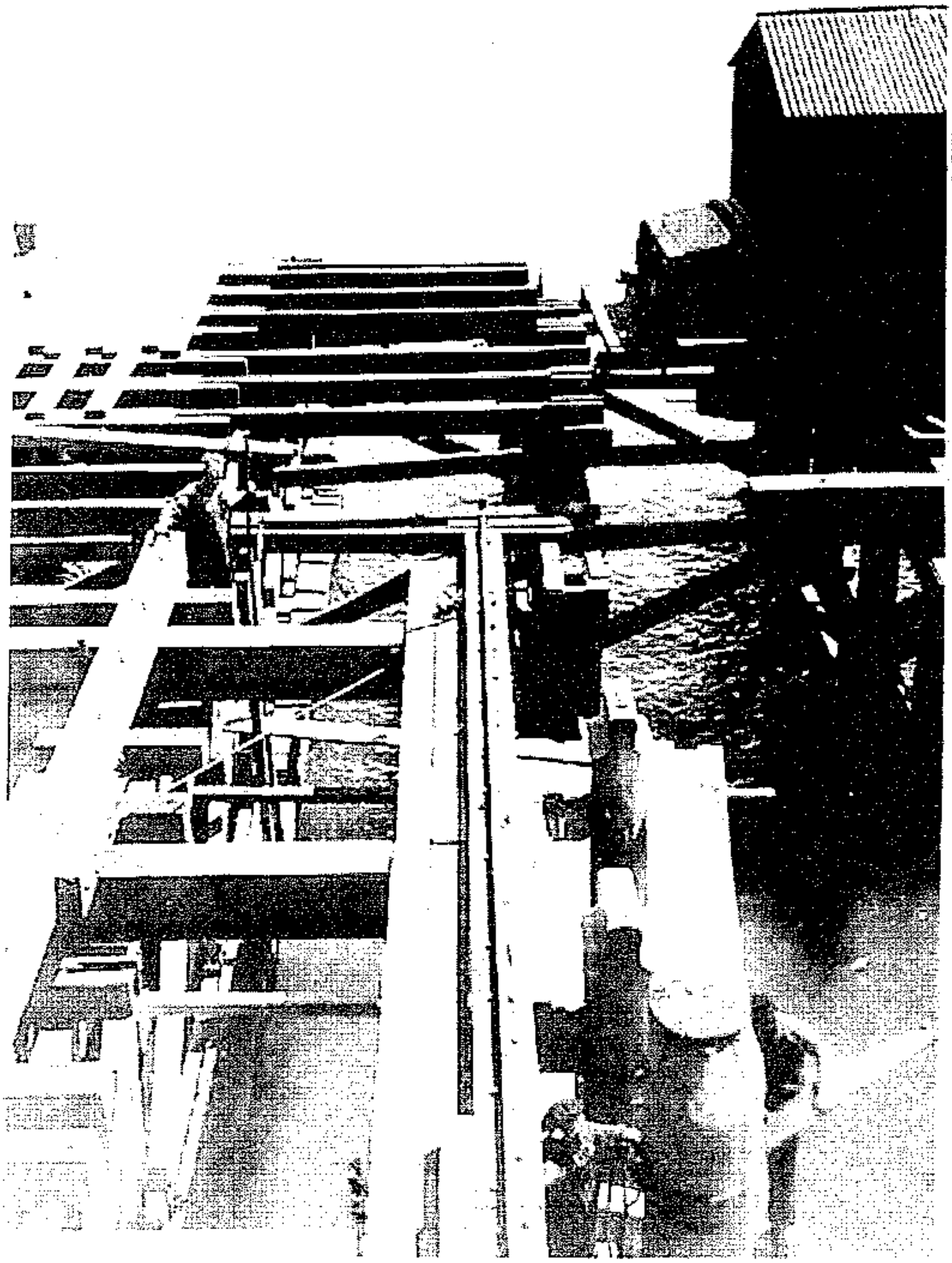


Bunbury 600 feet jetty extension 1952 – 1957

Driving the pile with a drop hammer – Note the " gallows" on the side just above the monkey which carried the SL 16A Drill over to the pile frame leads from which the machine was used to drill holes into the basalt on the sea bed prior to blasting with AN 75 five pound canister enclosed gelignite. The pile was then driven into the shattered rock.

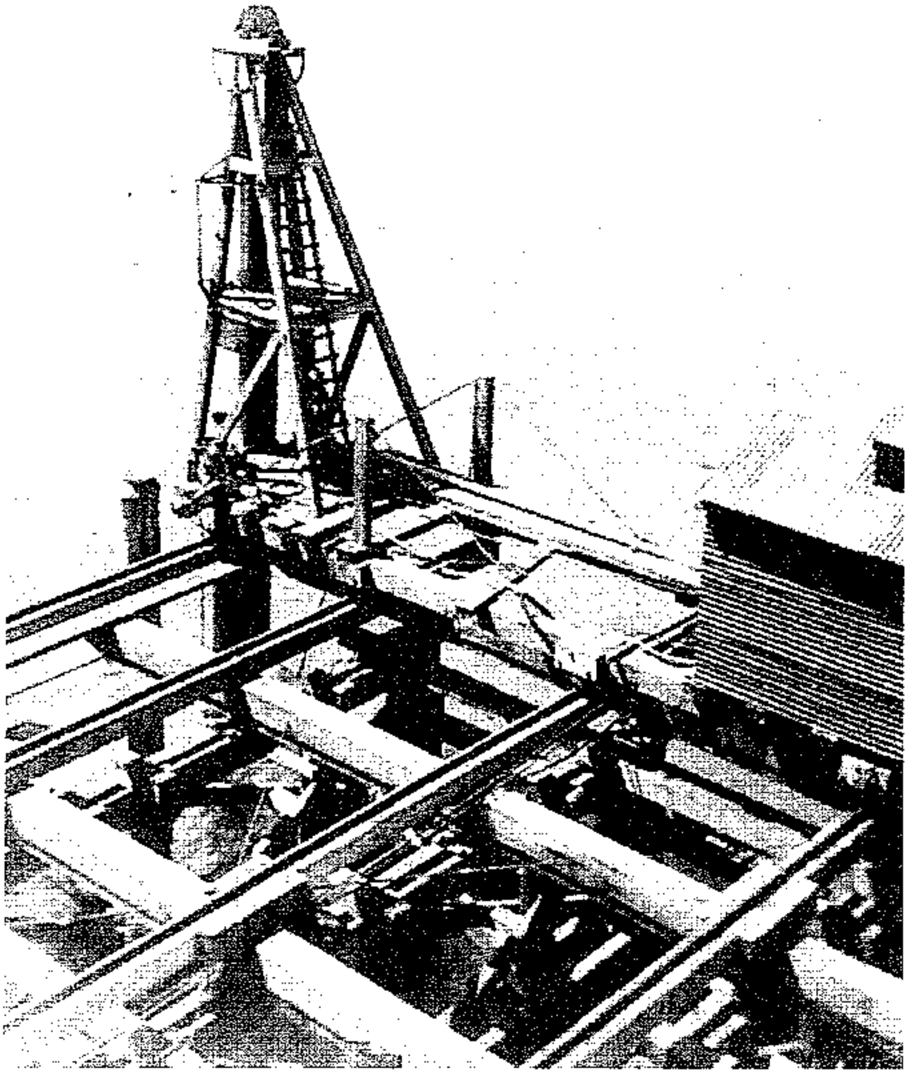


Bunbury 600 feet jetty extension 1952 – 1957
A general view looking towards the head showing the two of the pile driving outriggers with the pile frame on the right hand outrigger in position to drive the outside pile,



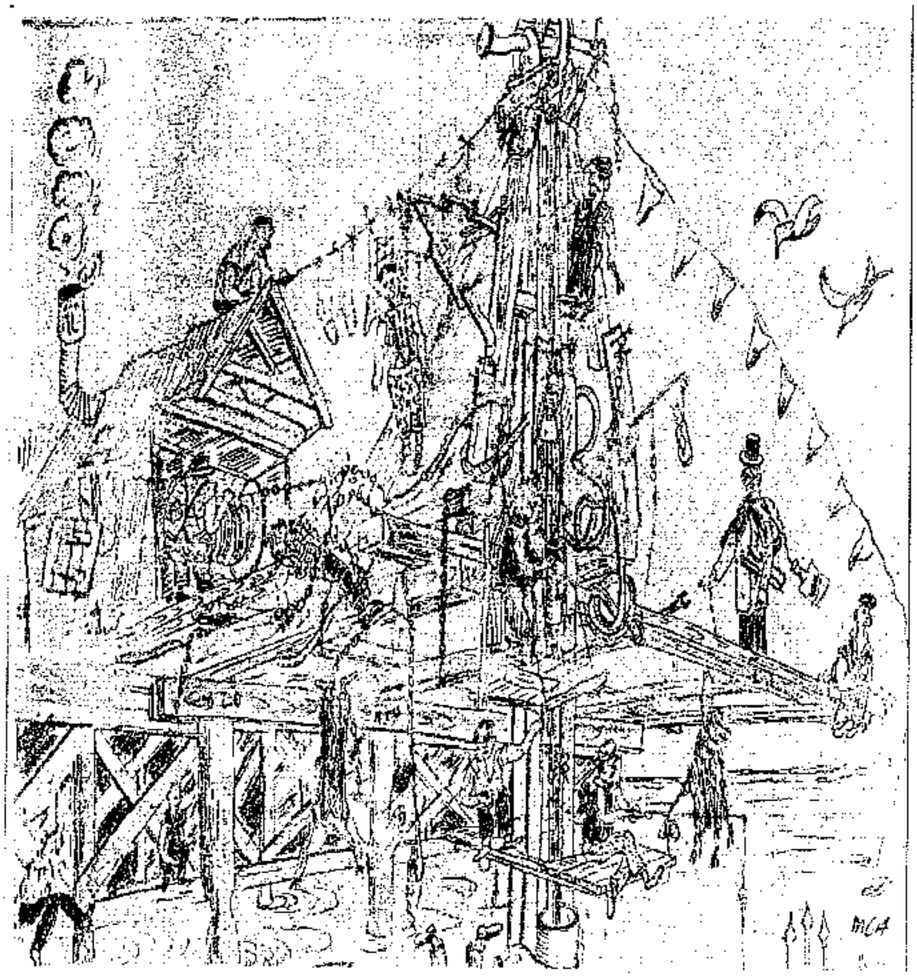
Bunbury 600 feet jetty extension 1952 – 1957

A view of the pile driving outriggers. The pile frame traveled on flanged wheels over the outrigger across the jetty. One frame covered six piles and the other covered five piles. The outriggers traveled out over rollers supported on the preceding half caps, which allowed the outrigger to cantilever out to 12 feet, the distance between the piers.



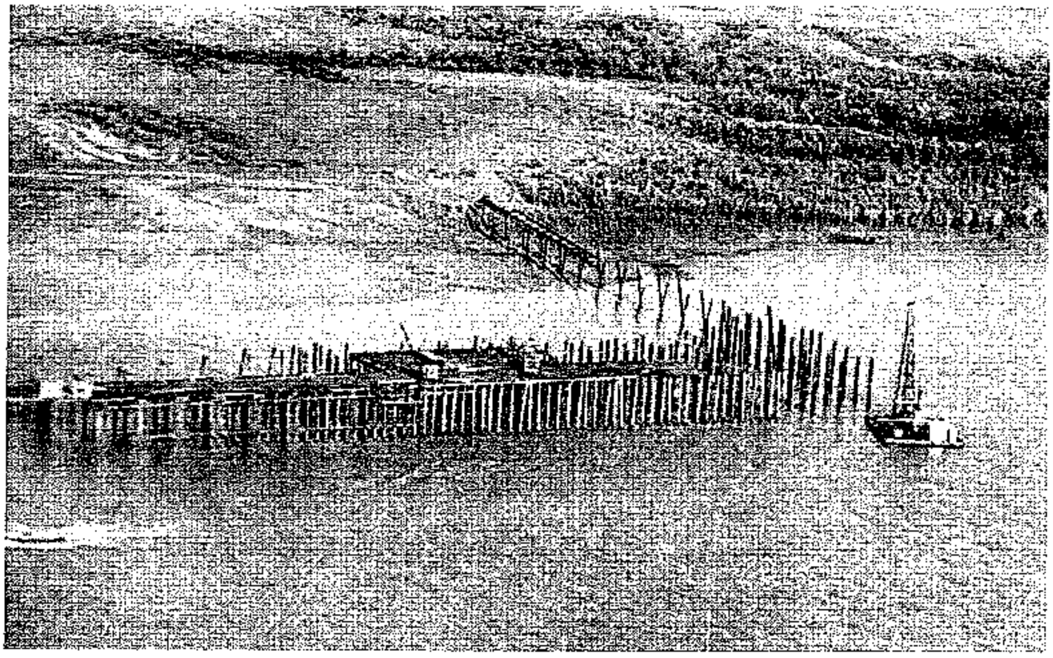
Bunbury 600 feet jetty extension 1952 – 1957

Another view of the pile driving outriggers, which traveled forward over inverted rollers secured to the top of the halfcaps. The transverse beams fixed to the outriggers carried the four sets of rails over which the pile frame traveled.

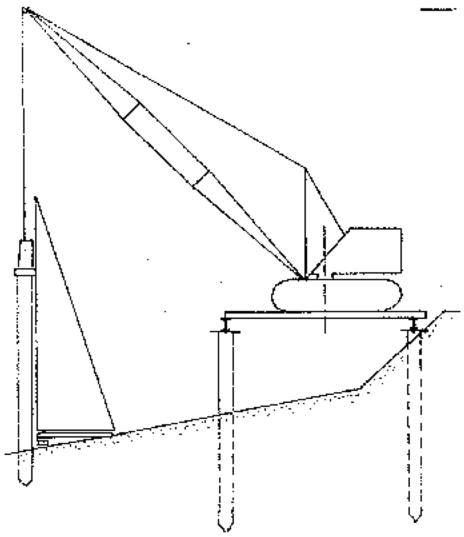


A much lighter side of pile driving using the cantilevered pile frame running on transverse ways. Any similarity to the method shown on the previous pages is purely coincidental.

Pile Driving Using Floating Plant



An aerial view of the Derby jetty during construction with the 60 feet high BSP pile frame on the 60feet by 44 feet pile punt on the lower right corner, There were 305 23 ¼ " tubular steel piles, 65 feet in length used in the jetty all of which were driven from floating plant. The only piles not driven from the water were 17" octagonal steel piles which were driven using conventional shore based plant.



The set up for the driving the abutment piles using a crane and conventional timber pile frame with steel leads and a drop monkey Once the steel deck was completed, the clear area was used to assemble the floating plant.

Plant used at Derby for driving piles from the water was

One Pile Punt comprising 8 x 4 rectangular and 8 x 1 scow Braithewaite boxes giving a clear deck area of 60 feet x 44 feet, to which was mounted –

One 50'/60' British Steel Piling (BSP) driving rig capable of driving up to a 1 in 3 forward or backward rake.

One Spencer Hopwood boiler No 22 oil fitted with water and fuel being carried in four of the rectangular boxes making up the punt.

One BSP 9B Steam Hammer (4 tons)

One BSP 10B Steam Hammer (5 tons)

Two 2inch petrol driven centrifugal pumps

\One steam driven pump

One BSP Piling Winch

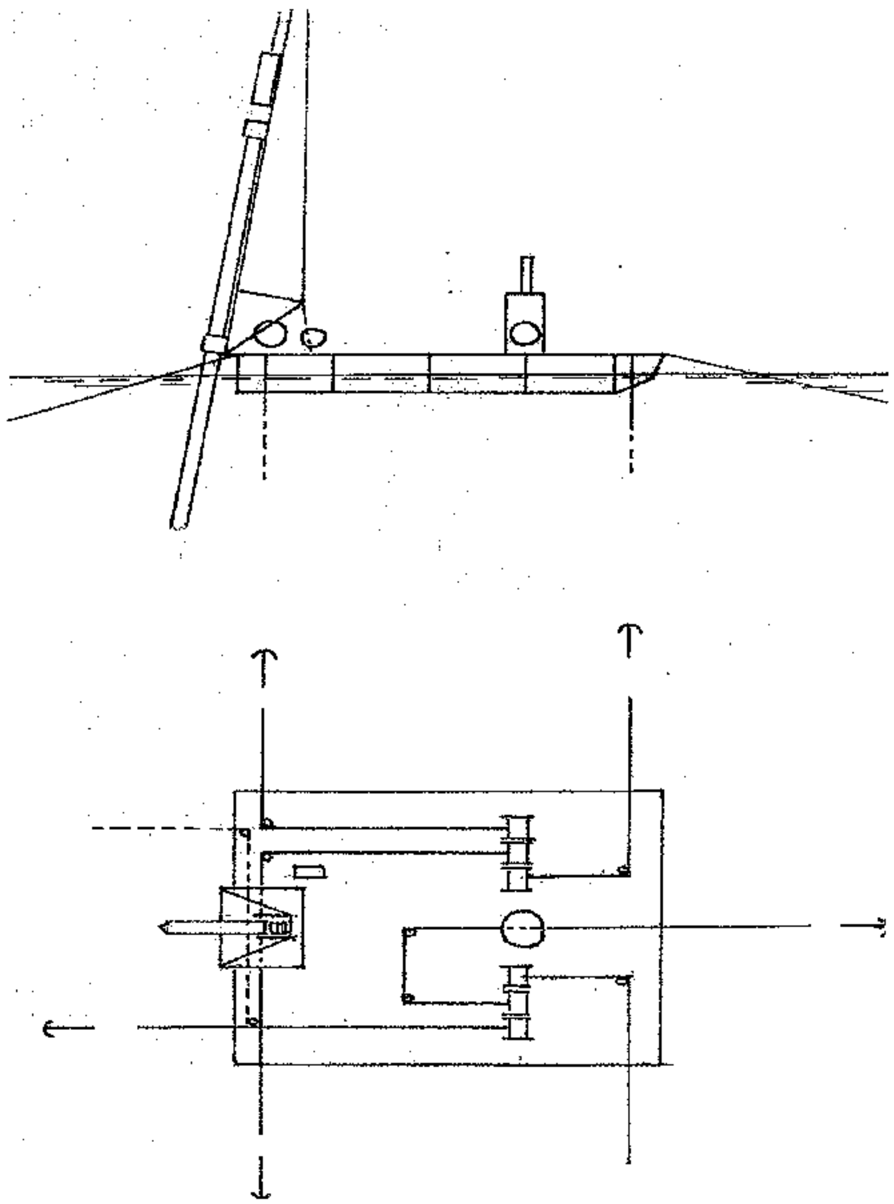
Two steam driven mooring winches

One 150 cft. Min, Atlas Copco Compressor

One 45 feet workboat powered by a 150 HP Grey Marine Diesel

One aluminium dinghy with outboard

One work punt comprising 4 x 2 rectangular Braithewaite boxes.



Schematic layout of the pile driving punt showing the mooring locations and the steam operated winches for positioning the punt. The winches used were ex the bucket dredge "Parmelia" and were capable of bringing the punt within a "centimetre" of the surveyed line - (the intersection of two sighted survey stations on shore based on triangulation fixed the position in both the horizontal and vertical plane, particularly with raking piles going around a curve with varying cut off levels.)

Appendix 10
Railways

From the earliest development of ports in Western Australia tramways and railways have played a very large part in both the operation of the port and the building of the port.

Practically all of the jetties built in the 1800s up to the mid 1900s were connected by a light rail to a goods yard on shore to transport cargo to and from the ship. In some cases the distance was only the length of the jetty itself, whilst at Port Hedand the Port Hedland to Marble Bar railway which was opened in 1909 was 114 miles long.

Rail operation and maintenance of rolling stock and the "permanent way' became a very important function in every port, not only for the construction phase but in the port operation, Even as late as 1960, North West and Kimberley ports even rebuilt their own rail wagons.

In the 1950s in the development of the outer harbour at Bunbury all materials used in the construction works were on rail transport. This involved the treatment and transport of timber piles and sawn timber for the jetty extension and the large rock for the extension of the breakwater.

(The treated timber piles were actually loaded onto jinkers at the pile treatment yard and transported by rail to the pile unloading jetty and lowered into the water to be towed out by launch to the jetty construction site.)

The Branch operated a 4 mile spur line from Roelands rail siding into the department's quarry on the Darling range escarpment. Rock blasted from the quarry was loaded onto end tipping and side tipping rail wagons traveling on temporary rails working from the quarry face and assembled in the marshalling yards at the quarry. The full rake was then delivered to the Roelands siding and taken over by the Western Australian Government Railways for transport to the Harbour Work sidings at Bunbury.

Apart from the rail operation at the quarry. The Harbour Works operated its own internal rail system within the port area at Bunbury with its own locomotives, wagons and rail mounted steam cranes Rock for the breakwater was delivered to the breakwater through a central rail siding for end tipping rock and through two spur lines for side tipping.

All " material assembly and dispatch" areas within the Works area were accessible by rail including the timber pile charring and tarring yard, the timber pile concrete sleeving area, the blacksmith shop and the pile loading jetty.

There was therefore within the Harbour Works organisition a specialised railway section which covered platelaying, wagon repairing, steam

locomotive and crane operation and maintenance, signaling and safety issues appertaining to the operation of a self contained rail system.

The jetty itself carried six parallel sidings across the width of the jetty in the outer berths with several crossovers with the points being operated from tumblers hung below the deck.

Jetty Rail Sidings and the Rail Trolley
Max Anderson's Story

All the workshops associated with the works at Bunbury were located on the shore close to the foot of the Jetty. The transport of most plant and materials was carried out by rail. We had a gang whose main job was the laying of rails tracks on the shore to the breakwater and to the Jetty. Most of the plant was rail mounted, including air compressors, welding plants and cranes. We had our own small steam locomotives to pull rail wagons along the internal rail system at Roelands and Bunbury.

Some of the smaller gear and materials were loaded on to small rail trolleys and pushed along by hand. On one occasion, the leading hand carpenter placing the beams. on the Jetty extension had asked one of his gang to hop on his bike and ride down the Jetty to the workshop and bring back an empty rail trolley. Fred did as he was told and returned an hour later pushing the rail trolley with one hand and wheeling his bike with the other hand. The rail setup on the Jetty consisted of the main line and a number of loop lines at each of the Jetty berths. At the take off to each loop there was the normal points system with a tumbler to switch the blades from one line to the other. It was the practice, as applies to gates in rural areas to leave the points as you found them.

When the leading hand asked Fred, what had taken him so long he replied, " Well, you know there's a lot of points to be changed along the Jetty between the shore and here and every time I came to one, I had to first of all put down me bike, walk over to the tumbler, throw the switch. push the trolley through and then go back and reset the tumbler." Then he added," Secondly I had to then walk back to me bike, pick it up and wheel it back to where I had left the trolley. That all took time."
The leading hand carpenter stood back in amazement and said, "Why the hell didn't you put your bike on the empty trolley?"

And Fred replied, Gee that's not a bad idea. Why didn't I think of that?

It is of interest to note that the extension of the Bunbury breakwater in the 1950s was the last one to have been built using side tipping and end tipping rail wagons for the transport and placing of rock. Future rock breakwaters were built using road transport with trucks capable of carrying individual rocks of up to 15 tonnes or more.

Appendix 11
Port Operation – Rate of Return

In order to measure the performance of the operations of a port from year to year or as against other ports the Port Authority Act was amended in 1987 to introduce a "yardstick" - the Rate of Return.

1 In accordance with the Acts Amendment (Port Authority) Act 1987, a Port Authority was required to submit annually an actual Rate of Return covering its activities for the current year

2. The Rate of Return, shown as a percentage, was derived by dividing the sum of the Net Surplus for the year less Current Cost Depreciation plus Interest by the Written Down Current Cost (WDCC) of Total Assets.

$$\text{Rate of Return} = 100 \times \frac{\text{(Net surplus for year - current cost depreciation +Interest)}}{\text{Written Down Current Cost of Total Assets}}$$

3. Assets included monetary and non- monetary items.

Non-monetary items fell into three categories being:

* Minor Operating Assets
* Major Operating Assets
* Community Assets

4. There were three bases for the calculation of the Written Down Current Costs of Major Operating Assets being

Market Buying Price
Replacement Cost
Reproduction Cost

6. Market Buying Price would be more applicable to assessing current costs of minor operating assets as vehicles, small items of plant, furnishings etc.

7. Reproduction cost would normally be an indexed cost to give the current cost of replicating an existing asset. In most cases this cost would be greater than that of the Replacement Cost due to the technological advancement which would have taken place over the intervening years.

8. In the derivation of WDCCs for the major operation assets in a port, the lower cost of each asset calculated as a Replacement Cost or as a Reproduction Cost would have been taken as the recommended WDCC.

9 Generalising this could cover

breakwater construction
dredging.
berths (wharves)
loading and unloading structures and plant
product pipelines

hard standing areas which have not been included elsewhere.

electrical installation which has not been included elsewhere.

major floating plant.

buildings used in the administration, operation and maintenance of the port.

10 Assets would have been itemized to cover the following

Description of asset.

Initial cost (historical) when the asset was acquired by the Port

Year asset was acquired.

Cost Index with 100 fixed to a base year

The Useful Life of the Asset being the estimated total period, from the date of acquiring the particular asset, over which the service potential of the asset is expected to be used in the business of the entity.

The Remaining Useful Life of the Asset – T his figure may vary from time to time depending on the useful life of the asset as defined above. Generally it would be the difference between the expiry date of the asset and the current year. However due to changes in the use of the asset, brought about by either structural or operational requirements this figure could be extended or reduced.

Current Replacement Cost is the cost of the replacement of the asset using current technology. For example the replacement of a timber spring pile fender system with a modern laminated rubber energy absorbing system.)

Accumulated Depreciation.

Written Down Current Cost being the difference between the Current Replacement Cost and the Accumulated Depreciation.

Current Cost of Replica or Reproduction Cost s the indexed cost of reproducing the asset without any technological advantages.

Accumulated Depreciation.

Written Down Current Cost being the difference between Current Reproduction Cost and the

Accumulated Depreciation.

Recommended Written Down Current Cost - The lower value of the WDCC bang shown as the Recommended Written Down Current Cost.

13 This cost could cover the following items -

Breakwater construction.

dredging of approach channel, harbour basin and berths.

wharves (referred as berths)

petroleum products receival installation.

hard standing areas including access roads, service roads and parking areas not included elsewhere.

electrical installation not included elsewhere.

buildings for port administration, operation and maintenance.

major floating plant.

Coasts which may not necessarily have been included in the foregoing include –

navigational aids - (could involve another navigation authority)

land reclaimed or otherwise

furnishings of buildings

plant including motor vehicles, equipment etc. use in construction, operation or maintenance.

consumable stores used in maintaining and operating the port

(This enabled comparisons on port operation versus rate of return to be made over a period of time at a particular port or a comparison in any particular time over a number of ports - at one stage a 10% rate of return was considered acceptable.)

Derby is famous for its huge tides. On the back of this comes a new claim to fame. Derby will become the only place in the world to produce electricity continuously from the tides. It will also have the second largest Tidal Power Station in the world.

These features alone will make the Derby area a 'world class tourist experience'.

Firsts

The Tidal Power Station will provide a lot of firsts:

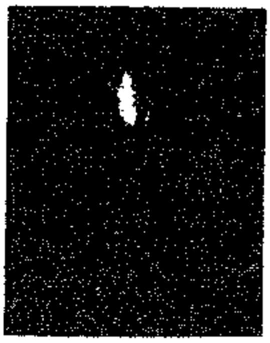
- *The first to be built in Australia.*
- *The first in the world to be able to produce continuous electricity.*
- *The first in tropical waters.*
- *The first using new turbine technology.*
- *The first to be able to incorporate business and recreational opportunities.*

Clean Renewable Energy

Electricity will be supplied from the Tidal Power Station to about 20,000 homes in Derby, Fitzroy Crossing and Broome. The need to run the noisy, smoky diesel generators will be reduced or even eliminated. Tidal energy is renewable, quiet, reliable, predictable and available. In the case of the Doctors Creek Tidal Power Station, tidal energy will be harnessed from water running between the west creek to the east creek via a channel cut between the two.

Fishing

But what of the fishing in the creek area? The western arm of Doctors Creek will be a water storage area with a small tidal range, highly suited to recreational fishing and aquaculture. The permanent water of the creek will become home for fish species where presently none exist.



Fish that occur in the Sound, will still access the creek system via the sluice gates in the west creek, however they will be prevented from entering the turbines. The forecast is for great fishing! The Fisheries Department have stated that aquaculture is a difficult enterprise in the Kimberley waters because of the extreme tidal ranges. The new tidal range in the west creek will provide conditions highly conducive to aquaculture.

The Department of Commerce and Trade is conducting studies into aquaculture and the tourism potential of the western creek.

Access

Improved access to the creek system is another great benefit of the Tidal Power Station. The central access road will provide public access to the Christine Point area and places in between. Safe roads and access ways will eliminate the need to abandon your vehicle on the mud flat as happened to the owner of the Ford station wagon still located in the mud near Christine Point. Boating enthusiasts will be able to use the high basin and may take their boats out to the Tidal Power Station to launch them into King Sound via a proposed boat ramp.

Tourists

The Tidal Power Station will have provision for tourists to explore the operation and infrastructure involved. The view from the top of the barrages will allow people to take in the Sound, West and East arms of the Creek and the spillway channel between the two arms.

It is expected that tour boats will take tourists along the 11km stretch of the Western Creek to the Tidal Power Station. Fishing and exploring the mangrove community along the way will provide tourists with photos, mementos and memories of a unique experience.

60

Appendix 13
Water Supply from Icebergs

The supplementing of the Perth water supply using icebergs towed from the Antarctic region was a proposal briefly looked at by the Branch in the 1980s

Transport of ice by sea was not new. In the early 1800s, well before refrigeration, large blocks of ice were transported as ships cargo from colder parts of the world to tropical areas. One of the earliest ice cargoes recorded was in 1806 when blocks of ice taken from a frozen Massachusetts lake were shipped from Boston to the tropical isle of Martinique. - (ref The Frozen Water Trade by Gavis Weightman 2003.)

However the 1980 proposal was on a much larger scale. It meant harnessing a one kilometer long iceberg and towing it from the Antarctic to Fremantle, "wedging" it in the Rottnest trench to the west of Rottnest Island. To minimise losses on route it was proposed that a skirt surround the periphery of the ice berg, Once anchored the melting ice would be pumped by pipeline to storages on shore.

Much like the tidal power this was ruled out due to cost and the logistics of the project.

However it is of interest that as late as May 2006 Britain's biggest water supplier, Thames Water was considering this towing of icebergs from the Arctic - the Cosmos Science magazine May 2006

LONDON, 17 May 2006 - Britain's biggest water supplier, Thames Water, is seriously considering towing icebergs from the Arctic to London to solve what could be the worst shortage in a century, a newspaper reported Wednesday.

"We have to look at any possible alternative, including towing icebergs from the Arctic and seeding rain clouds," Richard Aylard, of Thames Water, was quoted as saying The Times at a meeting Tuesday in London.

Admitting that many people might find the idea "daft," he could not rule out using icebergs. Thames Water has not determined whether it would make most sense to bring in icebergs from Greenland or northern Scandinavia, he added.
Aylard said other plans included transporting water across the North Sea by tanker from Scandinavia.

"Tankers from Scotland and Norway are something that has been looked at. If we get into an emergency situation that's the kind of thing we would be looking at," he said.

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